

Trouble-shooting instructions : BMW-5025

BOSCH system : Electronically controlled diesel fuel injection (EDC = Electronic Diesel Control)

Make of vehicle : BMW

Basic microcard : PKW-083

## TABLE OF CONTENTS

Section	Coordinates
Special features.....	02
Structure, usage.....	03
Safety and precautionary measures.....	03
Trouble-shooting chart.....	04
Self-diagnosis test table.....	09
Test specifications.....	19
Installation position of components.....	22
Electrical terminal diagram.....	25

## SPECIAL FEATURES

These brief instructions, valid at the time of publication, apply to the following BMW model:

524 td (E34)  
with electronically controlled diesel fuel injection (EDC = Electronic Diesel Control)

Engine: M 21 D 24 WA, 85 kW  
EU, 05.88 ->

Vehicles of the country versions

- Austria
- Switzerland

are additionally equipped with an EGR system.

\* EDC system EDC 1.1.2 with self-diagnosis and 2 control units.

\* The fault memory can be read out using the Pocket System Tester KTS 300 (0 684 400 300) with the program module PPG 204 as of status 09.01.89.

Note:

Further diagnosis possibilities (actuator diagnosis etc), which would be feasible with newer program-module statuses, are not evaluated with these vehicles.

Pay attention to operating instructions for KTS 300. Connection of the KTS 300 to the diagnosis socket in the vehicle is via the adapter lead 1 684 463 196 (BMW).

\* As an alternative to the KTS 300, the self-diagnosis can be read out by way of a flashing code (not possible with all control units).

SPECIAL FEATURES (continued)

- \* The flashing-code fault output is stimulated with the pedal-position sensor.
- \* Vehicles with automatic transmission are equipped with a transmission downshift block.
- \* A fuel pre-supply pump is installed in the fuel tank and is actuated via a relay.

STRUCTURE, USAGE

These brief instructions essentially comprise vehicle-specific special features and test specifications (set values).

In line with the customer complaint, the trouble-shooting chart outlines various causes/component faults. Detailed trouble-shooting information is given in the trouble-shooting chart in the basic instructions.

NOTE:  
Even if reference is made to basic instructions, the set values, terminal assignments and special features indicated in these vehicle-specific brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

Pay attention to the information given in the basic instructions, so as not to endanger people and to prevent damage to engine, trigger boxes and control units.

TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

1.	Diagnosis lamp
2.	Starting motor operates, engine fails to start or starts only with difficulty (warm and cold)
3.	Engine hunts when idling
4.	Harsh idle with warm engine
5.	High fuel consumption in conjunction with inadequate engine output and the formation of smoke
6.	Unsatisfactory performance
7.	Black fumes in full-load range in conjunction with hard engine running; possible loss of power
8.	Hard engine running
Cause (component fault)	
*	* Self-diagnosis
*	Voltage supply, control units
*	Injected-quantity adjuster
*	Control-collar travel sensor
*	Electric shutoff device (ELAB)
*	* Computer monitoring (control unit 2)
	* Solenoid-operated valve, start of injection
	* Electropneumatic switching valve (EGR)
	* Nozzle-holder assembly with needle-motion sensor (NBF)
	* Interface
	Computer communication
	* Engine-speed sensor
*	Engine-speed sensor and NBF
*	* Tank empty, tank ventilation
*	* Injection sequence not firing sequence



## TROUBLE-SHOOTING CHART (continued)

Customer complaint (fault symptoms)

1.	Diagnosis lamp
2.	Starting motor operates, engine fails to start or starts only with difficulty (warm and cold)
3.	Engine hunts when idling
4.	Harsh idling with warm engine
5.	High fuel consumption in conjunction with inadequate engine output and formation of smoke
6.	Unsatisfactory performance
7.	Black fumes in full-load range in conjunction with hard engine running; possible loss of power
8.	Hard engine running
Cause (component fault)	
*	Self-diagnosis
*	Inlet-union screw, fuel return line
*	Air in fuel system
*	Paraffin separation
*	Leakage in fuel lines
*	Supply lines clogged
*	Injection nozzle
*	Pump/engine assignment
*	Fuel filter
*	Glow plug system
*	Engine compression
*	Engine air filter
*	Engine management
*	Timing device
*	Turbocharger
*	Charge-air-pressure sensor
*	Fuel heating
*	EGR valve

## TROUBLE-SHOOTING CHART (continued)

Customer complaint (fault symptoms)

9.	Diagnosis lamp
10.	Engine missing when driving
11.	Engine cuts out automatically
12.	Engine runs at constant speed
13.	Engine doesn't run up when cold
14.	High idle or rough engine running at high speed
15.	Black fumes in full-load range
16.	Cloud of fumes in full-load range
Cause (component fault)	
*	Self-diagnosis
*	Pedal-position sensor and brake/brake safety switch
*	Injected-quantity adjuster
*	Control-collar travel sensor
*	Computer monitoring (control unit 1)
*	Engine-speed sensor and needle-motion sensor
*	Tank empty, tank ventilation
*	Injection sequence not firing sequence
*	Inlet-union screw, fuel return line
*	Air in fuel system
*	Paraffin separation
*	Leakage in fuel lines
*	Supply lines clogged

## TROUBLE-SHOOTING CHART (continued)

Customer complaint (fault symptoms)

- 9. Diagnosis lamp
- 10. Engine missing when driving
  - 11. Engine cuts out automatically
  - 12. Engine runs at constant speed
  - 13. Engine doesn't run up when cold
  - 14. High idle or rough engine running at high speed
  - 15. Black fumes in full-load range
  - 16. Cloud of fumes in full-load range

									Cause (component fault)
*	*	*	*	*	*	*	*	*	Self-diagnosis
				*			*	*	Pump/engine assignment
				*			*	*	Fuel filter
				*					Engine compression
			*						Safety switch, pedal-position sensor
*									Fuel heating
*									Electric shutoff device (ELAB)
				*					Engine-speed sensor

## TROUBLE-SHOOTING CHART (continued)

## Customer complaint (fault symptoms)

- 17. Diagnosis lamp
- 18. High idle
- 19. No road-speed control (FGR) operation possible
- 20. No EGR function
- 21. No idle speed increase

							Cause (component fault)
*	*	*	*	*			Self-diagnosis
			*				Computer monitoring
			*				Solenoid-operated valve, start of injection
			*				Electropneumatic switching valve (EGR)
			*				Nozzle-holder assembly with needle-motion sensor
*			*				Engine-speed sensor
*			*				Speed-signal sensor
		*					Switch, coupling or transmission neutral switch and/or brake/brake safety switch
			*				Air temperature sensor
			*				Engine temperature sensor
				*			A/C switch
		*					Operating element, road-speed control
		*					Interface
							Engine-speed signal
		*					Transmission downshift block
		*					Electropneumatic switching valve (automatic, FGR)

## SELF-DIAGNOSIS TEST TABLE

Pocket system tester Fault indication	Fault code	Flash- ing code	Test instructions/test conditions	Termi- nals	Set values
Temp. sensor Engine Op.circ./sh. to pos.  Short to ground	3	1	Test temperature sensor and lead for open-circuit (op. circ.), short-circuit to positive and short-circuit to ground. Temperature sensor, resistance: at 15...30°C at approx. 80°C	(CU 1) 23,35	1300...3600 Ω 250... 390 Ω
Speed-sig. sens. Incorrect/no signal	9	7	<u>Correct speed display:</u> engine plug term. 14-ground Test lead for open-circuit: engine plug term. 14-plug Instrument cluster term. 26 and engine plug term. 14-plug Control unit 1 term. 9  <u>No speed display:</u> test speed-signal sensor.  Test lead for open-circuit: speed-signal sensor – instrument cluster	(CU1) 9	> 4,5 V  9 pointer deflections/wheel revolution
Road-sp. cont. – Operating element Op.circ./sh. to pos.  Short to ground	10	3	Switch through FGR operating element positions: neutral N, reactivate RA, set (accelerate) S(a), set (decelerate) S(d), off. Measure voltages at term. 1 and term. 4.  Test leads for open-circuit (op. circ.), short-circuit to positive and short-circuit to ground.  Road-speed control (road-speed cont.) = FGR	(CU1) 26,35	N: 3,18...3,69 V RA: 1,43...1,94 V S(a): 0,57...1,08 V S(d): 2,35...2,86 V Off: 3,96...4,47 V
Interface Comp. communication Faulty	11	5	Test leads for open-circuit, kinking and crushing. Loose contacts at plug connections.  <u>Control unit 1 computer monitoring:</u> fault code/flashing code may not be indicated. If engine start not possible, control unit 1 defective.	(CU 1) 14,15 (CU 2) 9,12	

## SELF-DIAGNOSIS TEST TABLE (continued)

Pocket system tester Fault indication	Fault code	Flash- ing code	Test instructions/test conditions	Termi- nals	Set values
Interface Comp. communication Faulty	11	5	Control unit 2 computer monitoring: fault-memory interrogation not possible. Voltage at plug connection - solenoid valve, start of injection term. 1 with respect to ground with ignition on. If no voltage applied, control unit 2 defective.		12 V
Air-temp. sensor Op. circ./short to positive  Short to ground	12	6	Test temperature sensor and lead for open-circuit (op. circ.), short-circuit to positive and short-circuit to ground. Temperature-sensor resistance: at 15...30°C at approx. 80°C		1300...3600 Ω 250... 390 Ω
Eng.-speed sensor Op.circ/grnd short  Signal error	129	14*	Test leads for open-circuit and short-circuit to ground. Resistance, engine-speed sensor at approx. 20°C:  Connect MOT-Tester special input to plug, engine-speed sensor term. 1. MOT-Tester setting: 20 V, 100 ms. Test leads for open-circuit (op. circ.) and short-circuit to ground.  Resistance, engine-speed sensor at approx. 20°C: Connect MOT-Tester special input to plug, engine-speed sensor term. 1. MOT-Tester setting: 20 V, 100 ms.	(CU1) 31,35  (CU1) 31,35	900...1100 Ω   900...1100 Ω Signal pattern, see Coordinate: 20
Fuel temperature sensor Op.circ./sh. to pos.  Short to ground	130	4	Connect test adapter KDEP 1165, adapter leads KDEP 1165/300 and -/301.  Test temperature sensor and leads for open-circuit (op. circ.), short-circuit to positive and short-circuit to ground. Temperature-sensor resistance at 15...30°C: at 50...70°C:	(CU1) 24,35	1200...4000 Ω 300...1200 Ω

\* Serious fault, diagnosis lamp permanently lit

## SELF-DIAGNOSIS TEST TABLE (continued)

Pocket system tester Fault indication	Fault code	Flash- ing code	Test instructions/test conditions	Termi- nals	Set values
Pedal-p. sens. Potentiometer Signal too high  Signal too low  Comparison not O.K.	132	2	<p>Pedal-position-sensor resistance term. 2 and term. 4 as well as term. 1 and term. 4.</p> <p>Accelerator pedal is in idle position.</p> <p>Test leads for open-circuit (op. circ.), short-circuit to positive and short-circuit to ground. <u>Observe installation instructions for pedal-position sensor.</u></p> <p>Voltage at pedal-position sensor term. 1 and term. 4.</p> <p>Move accelerator pedal from idle to full-throttle position;</p> <p>Idle position:</p> <p>Full-throttle position:</p> <p><u>Comparison not O.K.</u></p> <p>Connect multimeter (A) to plug, pedal-position sensor term. 1 and term. 4, multimeter (B) to plug, pedal-position sensor term. 4 and term. 5. Multimeter A:</p> <p>Multimeter B:</p> <p>Move accelerator pedal from idle and full-throttle position. Step response (B) must result at set value (A).</p> <p>Test lead for open-circuit.</p> <p><u>Dynamic pedal-position-sensor monitoring:</u></p> <p>No fault indication. High idle, however reaction to accelerator-pedal movement taken place.</p> <p>Eliminate stiffness in accelerator-pedal actuator, check installation position of pedal-position sensor.</p>	<p>(CU1) 10,13, 17</p> <p>(CU1) 12</p>	<p>800...1400 <math>\Omega</math> 800...4110 <math>\Omega</math></p> <p>0,23...0,50 V 2,79...4,60 V</p> <p>0,56... 1,0 V 0... 5,5 V</p>

## SELF-DIAGNOSIS TEST TABLE (continued)

Pocket system tester Fault indication	Fault code	Flash- ing code	Test instructions/test conditions	Termi- nals	Set values
Ch.-air-pres sens Signal too high Signal too low	133	8	Voltage supply term. 1 (+) and term. 3. Test leads for open-circuit (op. circ.), short-circuit to ground and short-circuit to positive.  Measure voltage with connected charge-air-pressure sensor term. 2 (+) and term. 3.	(CU1) 28,34, 35	4.5...5.5 V  Characteristic curve, see Coord.: 20
Control-collar travel sensor Signal too high Signal too low	134	12	Connect test adapter KDEP 1165, adapter leads KDEP 1165/300 and -/301. Test voltage supply, socket 2 (+) and socket 3.  Measure resistance: sockets 2 and 3 as well as sockets 1 and 3  Test leads for open-circuit (op. circ.), short-circuit to ground and short-circuit to positive.  <u>Comparison not O.K.</u> Test prerequisites: engine-speed sensor, needle-motion sensor, computer communication interface O.K.  Test leads for open-circuit (see above). Visually inspect injected-quantity adjuster (safety precautions must be heeded).	(CU1) 6,10,29	4.5...5.5 V  1,0...3,0 k $\Omega$ 0,5...2,0 k $\Omega$
Inj.-qty.adjuster Closed loop Faulty	136	10*	Test adapter KDEP 1165, adapter leads KDEP 1165/300 and -/301. Test contact resistance term. 4 and 7 - ground.  Measure resistance, injected-quantity adjuster, term. 4 and 7. Test open-circuit in lead, contact resistance, term. 4 and term. 7.	(CU2) 1,21	0,4...0,7 $\Omega$

\* Serious fault, diagnosis lamp permanently lit

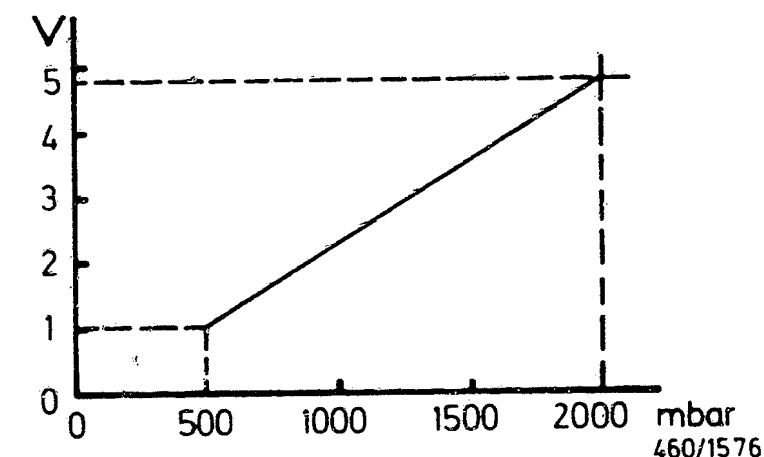
## SELF-DIAGNOSIS TEST TABLE (continued)

Pocket system tester Fault indication	Fault code	Flash- ing code	Test instructions/test conditions	Termi- nals	Set values
Needle-motion sensor Signal too high Signal too low	142	11*	Measure resistance, needle-motion sensor (approx. 20°...80°C) Test leads for open-circuit (op. circ.), short-circuit to positive and short-circuit to ground.  Test contact resistance, terminal posts, needle-motion sensor - ground:	(CU1) 1,20	90... 135 $\Omega$
Start of inj. Closed-loop control Faulty	144	15	Measure resistance, solenoid valve: Test solenoid valve and leads for open-circuit (op. circ.), short-circuit to positive and short-circuit to ground.  Remove fuel-injection pump and test supply pump pressure and timing-device profile.	(CU2) 1,2	14,3...17,3 $\Omega$
Interface Eng.-speed signal Faulty	145	—	Test leads for open-circuit.	(CU 1) 8 (CU 2) 6	
Brake/ brake safety switch Comparison not O.K.	146	—	Brake/brake safety switch (br./br. safety switch) Connect a multimeter to each circuit. Actuate brake pedal several times. Step response: Test voltage supply:  Test leads for open-circuit and contact resistance.	(CU 1) 5,11	Infinity $\Omega$ to approx. 0 $\Omega$ 11,5...14,5 V

\* Serious fault, diagnosis lamp permanently lit

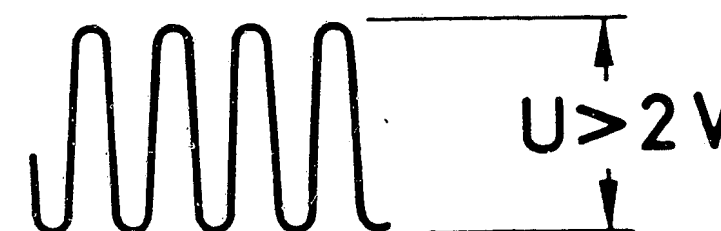
# TEST SPECIFICATIONS

Component/Function	Set values	
Idle speed (engine at operating temp., approx. 80° C):		
	Vehicle not moving	Driving speed (>2 km/h)
Manual gear change	750 min <sup>-1</sup>	820 min <sup>-1</sup>
Automatic transm.	750 min <sup>-1</sup>	750 min <sup>-1</sup>
A/C on	800 min <sup>-1</sup>	800 min <sup>-1</sup>
Engine cold	750...1045 min <sup>-1</sup>	
Nozzle opening pressure:	150 + 8 bar	
Pump/engine assignment:		
Setting:		
* Engine setting:	Cylinder 1 at TDC	
* Pump setting	1.05 mm after BDC	
Check value:		
* Engine setting:	Cylinder 1 at TDC	
* Pump setting:	1.03 – 1.07 mm after BDC	
Compression:	25...30 bar	
Max. cylinder deviation:	5 bar	
Filter test; max. permissible difference in pressure:		
	0.3 bar	
Pressure loss:	max. perm. 25 %	
Vacuum, vacuum pump	>500 mbar	
Electropneum. switching valve (resistance, EGR and FGR)	27...33 Ω	
Charge-air pressure	0.82...0.88 bar	
Blow-off valve, ch.-air pressure	0.90...1.10 bar	
Automatic transmission/downshift block		
Cut-in speed (increasing) :	170 km/h	
Cut-out speed (decreasing):	160 km/h	
Setting X, bracket, control box (FGR)		
	35.5...36.5mm	



Charac. curve, charge-air-pres. sens.

Signal pattern, engine-speed sensor



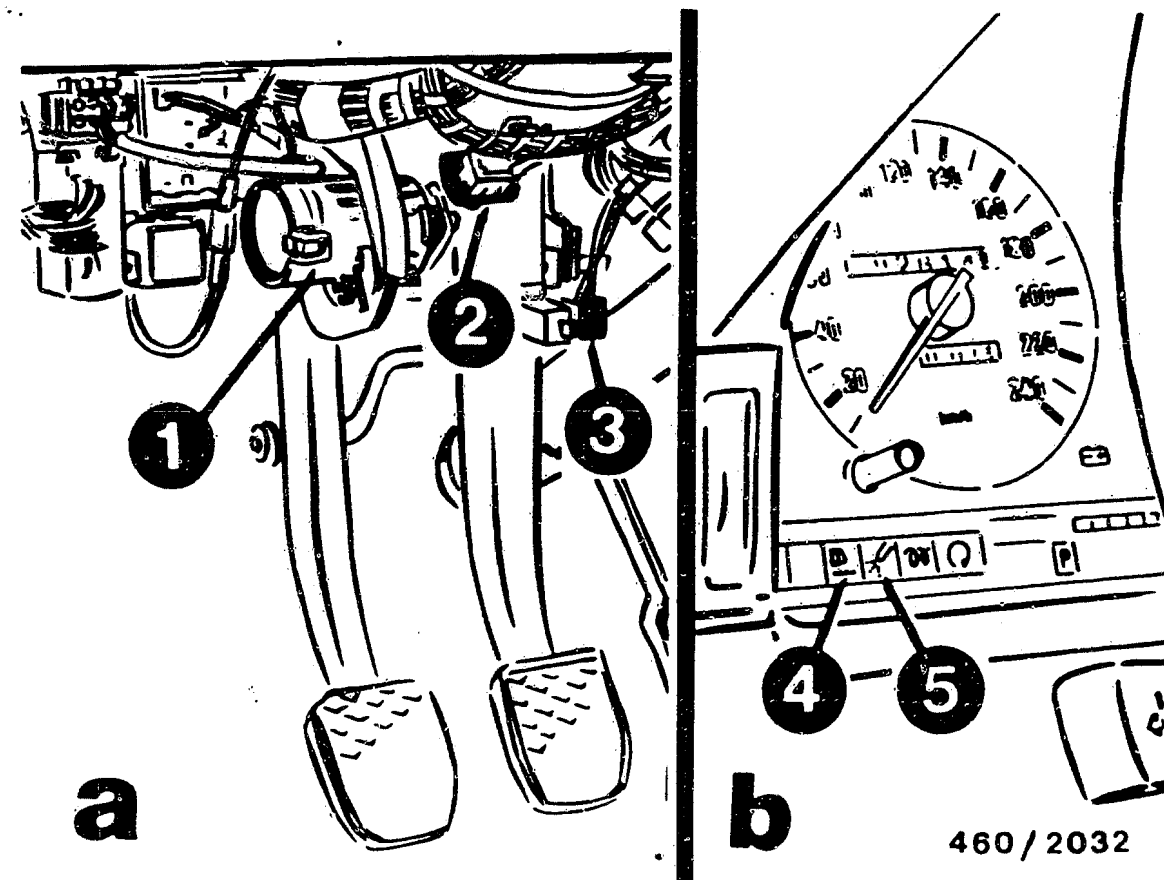
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# TEST SPECIFICATIONS (CONTINUED)

## Tightening torques

Fuel lines	25 Nm
Fastening screws, injection pump	20 Nm
Fastening screws, nozzle-holder assembly	40...45 Nm
Sheathed-element glow plugs	25 Nm
Screw plug	15 Nm
Cylinder-head-cover screws	7.5 Nm
Nut, injection-pump drive gear	45...50 Nm
Nut, camshaft gear	65...70 Nm
Tensioning-wheel mounting on engine (nut and bolt)	20...24 Nm
Toothed-belt pulley of jack shaft	55...65 Nm
V-belt pulley/vibration damper	22...24 Nm
Tensioning torque for tensioning- roller mounting (new toothed belt)	45...50 Nm
Tightening torque for tensioning- roller mounting (toothed-belt already run > 16 000 km)	30...35 Nm
Bleeder screw/thermostat housing	6...10 Nm



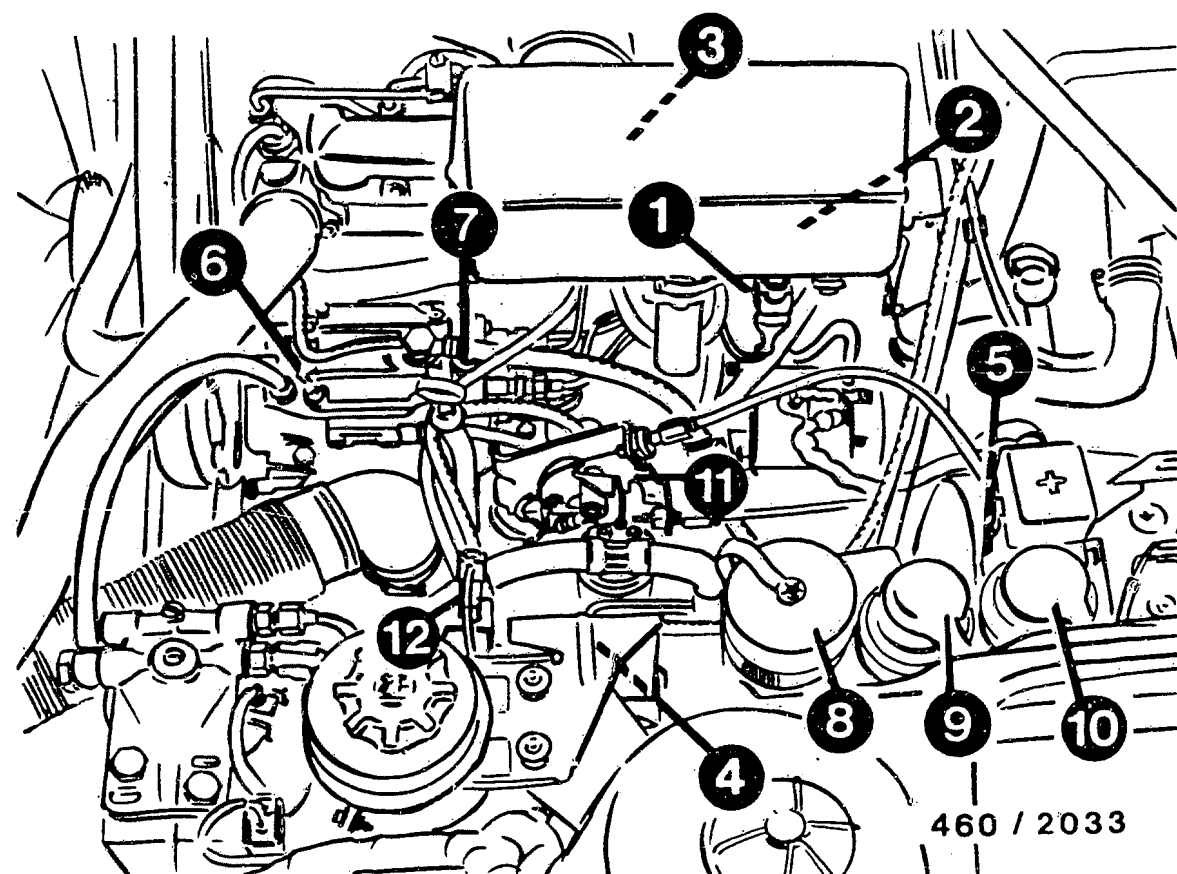
- 1 = Pedal-position sensor
- 2 = Switch, coupling
- 3 = Brake/brake safety switch
- 4 = Indicator, water-level sensor
- 5 = Diagnosis lamp

### INSTALLATION POSITION OF COMPONENTS

The road-speed pickup is attached to the differential housing.

The road-speed-control operating element is located beneath the lever for actuating the windshield wipers.

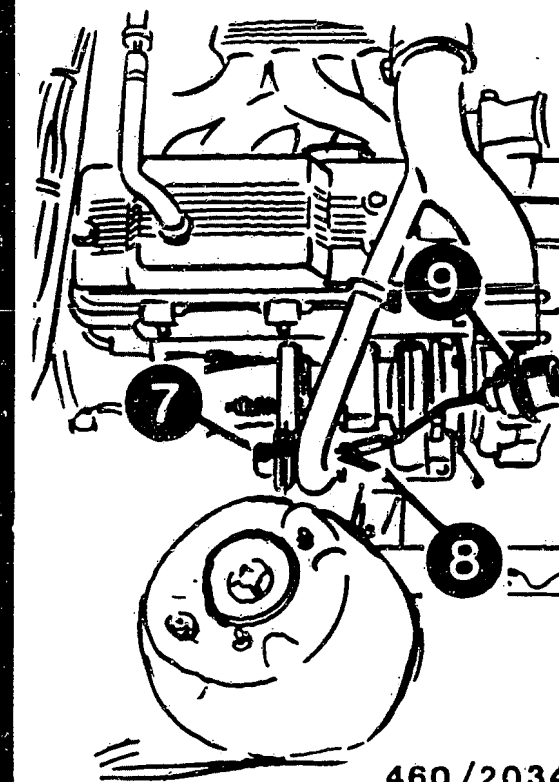
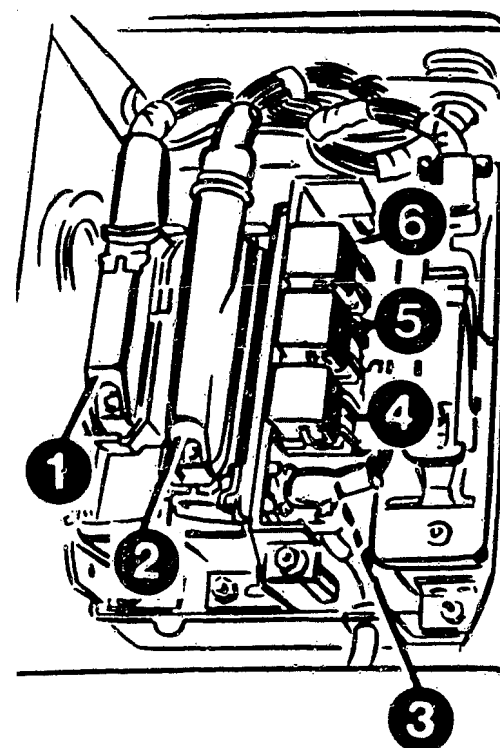
The electropneumatic switching valve (downshift block) is installed in the transmission; the transmission neutral switch is installed in the gear-shift console.



- 1 = Air temperature sensor
- 2 = Engine temperature sensor
- 3 = Nozzle-holder assembly with NBF (cyl. 4)
- 4 = Charge-air-pressure sensor
- 5 = Engine-speed sensor
- 6 = Fuel-injection pump
- 7 = ELAB
- 8 = Diagnosis plug
- 9 = Engine plug 2
- 10 = Engine plug 1
- 11 = Automatic transmission control (control box (FGR) and transmission indicator on one holding plate)
- 12 = Electropneumatic switching valve (FGR)

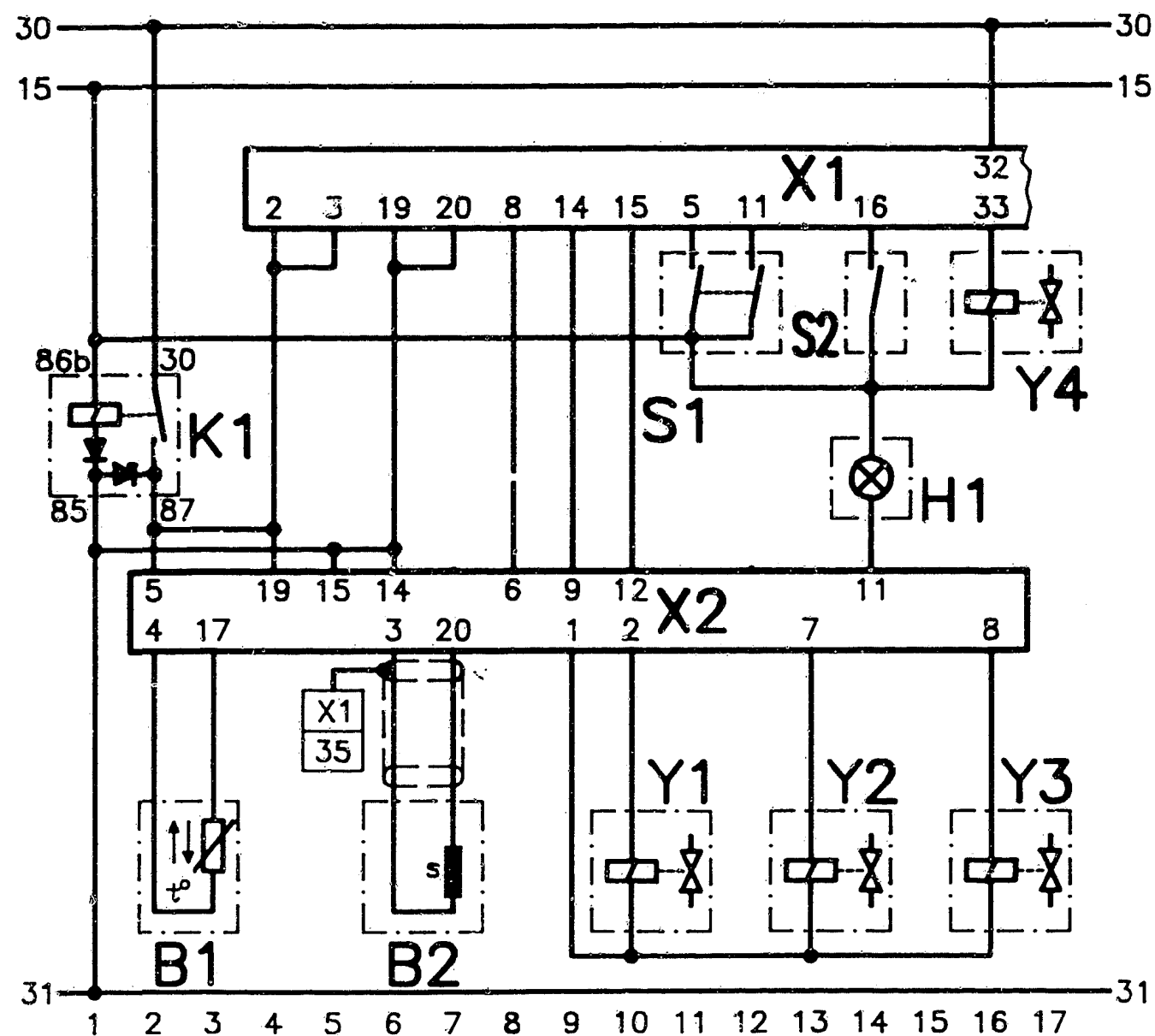
#### INSTALLATION POSITION OF COMPONENTS (continued)

Solenoid-operated valve for start of injection and fuel temperature sensor are installed in fuel-injection pump.



#### INSTALLATION POSITION OF COMPONENTS (continued)

- 1 = Control unit 2
- 2 = Control unit 1
- 3 = Glow-duration unit (not visible in picture)
- 4 = Pre-supply pump relay
- 5 = Fuel-heating relay
- 6 = Reversed-polarity protection relay
- 7 = EGR valve
- 8 = Bypass-flap actuator
- 9 = Control box



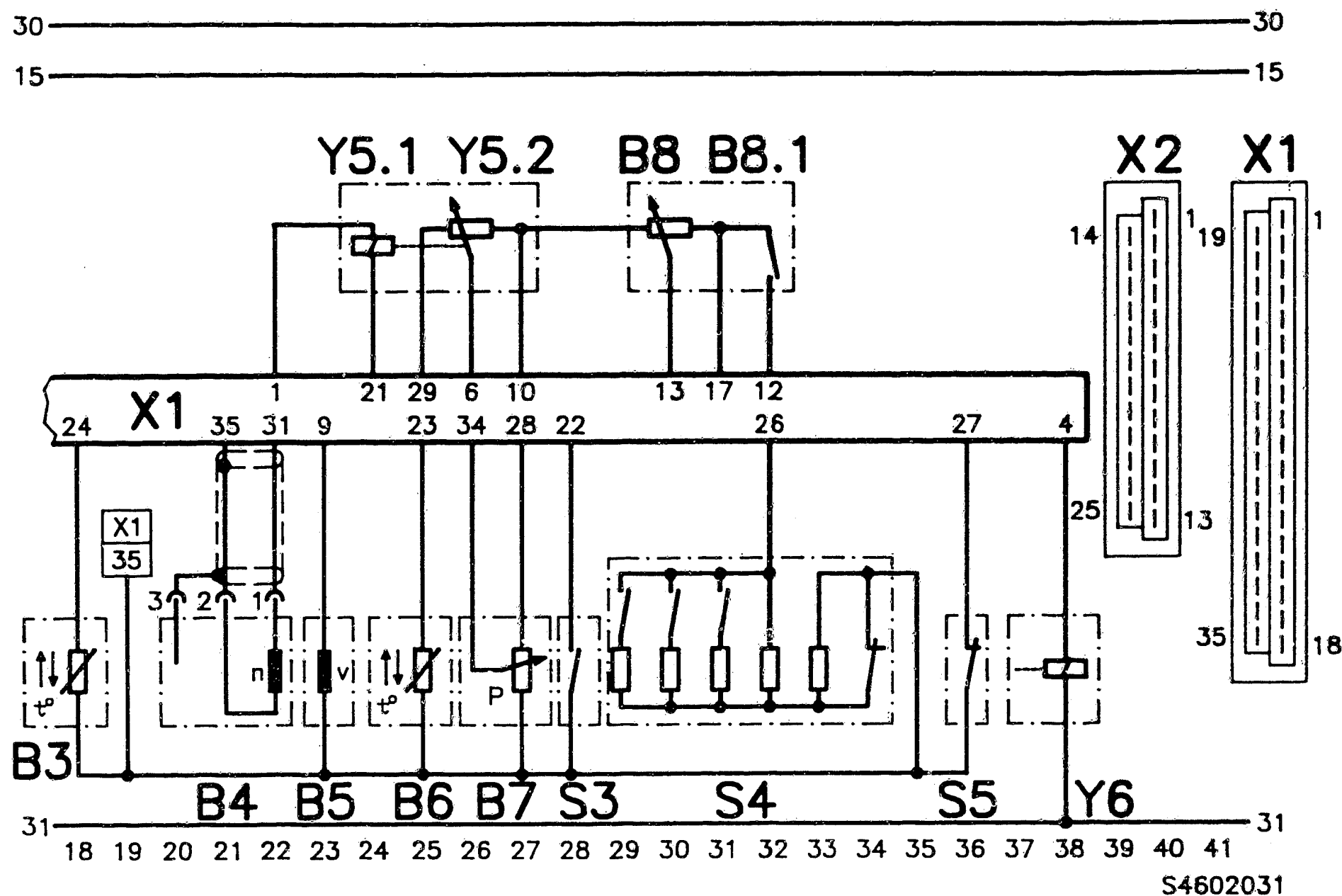
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# ELECTRICAL TERMINAL DIAGRAM

B1 = Air temperature sensor  
 B2 = Needle-motion sensor  
 H1 = Diagnosis lamp  
 K1 = Reversed-polarity protection relay  
 S1 = Brake/brake safety switch  
 S2 = A/C switch  
 X1 = Control unit 1  
 X2 = Control unit 2

Y1 = Solenoid-operated valve, start of injection  
 Y2 = Electropneumatic switching valve (EGR)  
 Y3\* = Electropneumatic switching valve  
 Y4\* = Transmission downshift block

(\* Only for vehicles with automatic transmission)



# ELECTRICAL TERMINAL DIAGRAM (CONTINUED)

B3 = Fuel temperature sensor  
 B4 = Engine-speed sensor  
 B5 = Speed-signal sensor  
      (speedometer signal)  
 B6 = Engine temperature sensor  
 B7 = Charge-air-pressure sensor  
 B8 = Pedal-position sensor  
 B8.1 = Safety switch  
 S3 \* = Transmission indicator

S4 = Road-speed-control operating element  
 S5 = Switch, coupling (for vehicles with  
      automatic transmission, transmission  
      neutral switch)  
 X1 = Control unit 1  
 X2 = Control unit 2  
 Y5.1 = Injected-quantity adjuster  
 Y5.2 = Control-collar travel sensor  
 Y6 = Electric shutoff device

(\* Only for vehicles with automatic transmission)

Trouble-shooting instructions : BMW-5012

BOSCH system : Electronically controlled diesel fuel injection (EDC = Electronic Diesel Control)

Make of vehicle : BMW

Basic microcard : PKW-083

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SPECIAL FEATURES

These brief instructions, valid at the time of publication, apply to the following BMW model:

324 td (E30)  
with electronically controlled diesel fuel injection (EDC = Electronic Diesel Control)

Engine: M 21 D 24 WA, 85 kW  
EU, 09.87 ->

Vehicles of the country versions  
- Austria  
- Switzerland  
are additionally equipped with an EGR system.

- \* EDC system EDC 1.1.2 with self-diagnosis and 2 control units.
- \* The fault memory can be read out using the Pocket System Tester KTS 300 (0 684 400 300) with the program module PPG 204 as of status 09.01.89.  
  
Note:  
Further diagnosis possibilities (actuator diagnosis etc), which would be feasible with newer program-module statuses, are not evaluated with these vehicles.  
  
Pay attention to operating instructions for KTS 300. Connection of the KTS 300 to the diagnosis socket in the vehicle is via the adapter lead 1 684 463 196 (BMW).
- \* As an alternative to the KTS 300, the self-diagnosis can be read out by way of a flashing code (not possible with all control units).

SPECIAL FEATURES (continued)

\* Up to variant no. 3t2 (control unit 1) the flashing-code fault output is stimulated with the flashing-code evaluation unit KDAW 9980.  
As of variant no. 3t3 (control unit 1) the flashing-code fault output is stimulated using the pedal-position sensor.

Note:  
The control unit must be removed in order to establish the variant no. This can be avoided if the following procedure is employed:  
Effect stimulation with pedal-position sensor. If this is not possible, self-diagnosis is stimulated using the flashing-code evaluation unit KDAW 9980.

STRUCTURE, USAGE

These brief instructions essentially comprise vehicle-specific special features and test specifications (set values).

In line with the customer complaint, the trouble-shooting chart outlines various causes/component faults. Detailed trouble-shooting information is given in the trouble-shooting chart in the basic instructions.

NOTE:  
Even if reference is made to basic instructions, the set values, terminal assignments and special features indicated in these vehicle-specific brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

Pay attention to the information given in the basic instructions, so as not to endanger people and to prevent damage to engine, trigger boxes and control units.

TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

1.	Diagnosis lamp
2.	Starting motor operates, engine fails to start or starts only with difficulty (warm and cold)
3.	Engine hunts when idling
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6.	Unsatisfactory performance
7.	Black fumes in full-load range in conjunction with hard engine running; possible loss of power
8.	Hard engine running
Cause (component fault)	
*	* * * * * Self-diagnosis
	* Voltage supply, control units
	* Injected-quantity adjuster
	* Control-collar travel sensor
	* Electric shutoff device (ELAB)
	* * Computer monitoring (control unit 2)
	* * Solenoid-operated valve, start of injection
	* * Electropneumatic switching valve (EGR)
	* * Nozzle-holder assembly with needle-motion sensor (NBF)
	* * Interface
	* * Computer communication
	* * Engine-speed sensor
	* * Engine-speed sensor and NBF
	* * Tank empty, tank ventilation
	* * Injection sequence not firing sequence

## TROUBLE-SHOOTING CHART (continued)

Customer complaint (fault symptoms)

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Cause (component fault)	
*	Self-diagnosis
*	Inlet-union screw, fuel return line
*	Air in fuel system
*	Paraffin separation
*	Leakage in fuel lines
*	Supply lines clogged
*	Injection nozzle
*	Pump/engine assignment
*	Fuel filter
*	Glow plug system
*	Engine compression
*	Engine air filter
*	Engine management
*	Timing device
*	Turbocharger
*	Charge-air-pressure sensor
*	Boost-pressure control
*	Fuel heating
*	EGR valve

## TROUBLE-SHOOTING CHART (continued)

Customer complaint (fault symptoms)

9.	Diagnosis lamp
10.	Engine missing when driving
11.	Engine cuts out automatically
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16.	Cloud of fumes in full-load range
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*	Self-diagnosis
*	Pedal-position sensor and brake/brake safety switch
*	Injected-quantity adjuster
*	Control-collar travel sensor
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*	Engine-speed sensor and needle-motion sensor
*	Tank empty, tank ventilation
*	Injection sequence not firing sequence
*	Inlet-union screw, fuel return line
*	Air in fuel system
*	Paraffin separation
*	Leakage in fuel lines
*	Supply lines clogged

## TROUBLE-SHOOTING CHART (continued)

Customer complaint (fault symptoms)

9.	Diagnosis lamp
10.	Engine missing when driving
11.	Engine cuts out automatically
12.	Engine runs at constant speed
13.	Engine doesn't run up when cold
14.	High idle or rough engine running at high speed
15.	Black fumes in full-load range
16.	Cloud of fumes in full-load range
Cause (component fault)	
*	Self-diagnosis
*	Pump/engine assignment
*	Fuel filter
*	Engine compression
*	Safety switch, pedal-position sensor
*	Fuel heating
*	Electric shutoff device (ELAB)
*	Engine-speed sensor

## TROUBLE-SHOOTING CHART (continued)

Customer complaint (fault symptoms)

17.	Diagnosis lamp
18.	High idle
19.	No road-speed control (FGR) operation possible
20.	No EGR function
21.	No idle speed increase
Cause (component fault)	
*	Self-diagnosis
*	Computer monitoring
*	Solenoid-operated valve, start of injection
*	Electropneumatic switching valve (EGR)
*	Nozzle-holder assembly with needle-motion sensor
*	Engine-speed sensor
*	Speed-signal sensor
*	Switch, coupling or transmission neutral switch and/or brake/brake safety switch
*	Air temperature sensor
*	Engine temperature sensor
*	A/C switch
*	Operating element, road-speed control
*	Interface Engine-speed signal
*	Electropneumatic switching valve (automatic, RSC)



## SELF-DIAGNOSIS TEST TABLE

Pocket system tester Fault indication	Fault code	Flash- ing code	Test instructions/test conditions	Termi- nals	Set values
Temp. sensor Engine Op.circ./sh. to pos. Short to ground	3	1	Test temperature sensor and lead for open-circuit (op. circ.), short-circuit to positive and short-circuit to ground. Temperature sensor, resistance: at 15...30°C at approx. 80°C	(CU 1) 23,35	1300...3600 $\Omega$ 250... 390 $\Omega$
Speed-sig. sens. Incorrect/no signal	9	7	<u>Correct speed display:</u> engine plug term. 14-ground Test lead for open-circuit: engine plug term. 14-plug Instrument cluster term. 26 and engine plug term. 14-plug Control unit 1 term. 9  <u>No speed display:</u> test speed-signal sensor.  Test lead for open-circuit: speed-signal sensor - instrument cluster	(CU1) 9	> 4,5 V  9 pointer deflections/wheel revolution
Road-sp. cont. - Operating element Op.circ./sh. to pos. Short to ground	10	3	Switch through FGR operating element positions: neutral N, reactivate RA, set (accelerate) S(a), set (decelerate) S(d), off. Measure voltages at term. 1 and term. 4.  Test leads for open-circuit (op. circ.), short-circuit to positive and short-circuit to ground.  Road-speed control (road-speed cont.) = FGR	(CU1) 26,35	N: 3,18...3,69 V RA: 1,43...1,94 V S(a): 0,57...1,08 V S(d): 2,35...2,86 V Off: 3,96...4,47 V
Interface Comp. communication Faulty	11	5	Test leads for open-circuit, kinking and crushing. Loose contacts at plug connections.  <u>Control unit 1 computer monitoring:</u> fault code/flashing code may not be indicated. If engine start not possible, control unit 1 defective.	(CU 1) 14,15 (CU 2) 9,12	

## SELF-DIAGNOSIS TEST TABLE (continued)

Pocket system tester Fault indication	Fault code	Flash- ing code	Test instructions/test conditions	Termi- nals	Set values
Interface Comp. communication Faulty	11	5	Control unit 2 computer monitoring: fault-memory interrogation not possible. Voltage at plug connection - solenoid valve, start of injection term. 1 with respect to ground with ignition on. If no voltage applied, control unit 2 defective.		12 V
Air-temp. sensor Op. circ./short to positive  Short to ground	12	6	Test temperature sensor and lead for open-circuit (op. circ.), short-circuit to positive and short-circuit to ground. Temperature-sensor resistance: at 15...30°C at approx. 80°C		1300...3600 Ω 250... 390 Ω
Eng.-speed sensor Op.circ/grnd short  Signal error	129	14*	Test leads for open-circuit and short-circuit to ground. Resistance, engine-speed sensor at approx. 20°C:  Connect MOT-Tester special input to plug, engine-speed sensor term. 1. MOT-Tester setting: 20 V, 100 ms. Test leads for open-circuit (op. circ.) and short-circuit to ground.  Resistance, engine-speed sensor at approx. 20°C: Connect MOT-Tester special input to plug, engine-speed sensor term. 1. MOT-Tester setting: 20 V, 100 ms.	(CU1) 31,35  (CU1) 31,35	900...1100 Ω   900...1100 Ω Signal pattern, see Coordinate: 20
Fuel temperature sensor Op.circ./sh. to pos.  Short to ground	130	4	Connect test adapter KDEP 1165, adapter leads KDEP 1165/300 and -/301.  Test temperature sensor and leads for open-circuit (op. circ.), short-circuit to positive and short-circuit to ground. Temperature-sensor resistance at 15...30°C: at 50...70°C:	(CU1) 24,35	1200...4000 Ω 300...1200 Ω

\* Serious fault, diagnosis lamp permanently lit

SELF-DIAGNOSIS TEST TABLE (continued)

Pocket system tester Fault indication	Fault code	Flash- ing code	Test instructions/test conditions	Termi- nals	Set values
Pedal-p. sens. Potentiometer Signal too high  Signal too low  Comparison not O.K.	132	2	<p>Pedal-position-sensor resistance term. 2 and term. 4 as well as term. 1 and term. 4.</p> <p>Accelerator pedal is in idle position.</p> <p>Test leads for open-circuit (op. circ.), short-circuit to positive and short-circuit to ground. <u>Observe installation instructions for pedal-position sensor.</u></p> <p>Voltage at pedal-position sensor term. 1 and term. 4.</p> <p>Move accelerator pedal from idle to full-throttle position;</p> <p>Idle position:</p> <p>Full-throttle position:</p> <p><u>Comparison not O.K.</u></p> <p>Connect multimeter (A) to plug, pedal-position sensor term. 1 and term. 4, multimeter (B) to plug, pedal-position sensor term. 4 and term. 5. Multimeter A:</p> <p style="padding-left: 40px;">Multimeter B:</p> <p>Move accelerator pedal from idle and full-throttle position. Step response (B) must result at set value (A).</p> <p>Test lead for open-circuit.</p> <p><u>Dynamic pedal-position-sensor monitoring:</u></p> <p>No fault indication. High idle, however reaction to accelerator-pedal movement taken place.</p> <p>Eliminate stiffness in accelerator-pedal actuator, check installation position of pedal-position sensor.</p>	<p>(CU1) 10,13, 17</p> <p>(CU1) 12</p>	<p>800...1400 <math>\Omega</math> 800...4110 <math>\Omega</math></p> <p>0,23...0,50 V 2,79...4,60 V</p> <p>0,56... 1,0 V 0... 5,5 V</p>

## SELF-DIAGNOSIS TEST TABLE (continued)

Pocket system tester Fault indication	Fault code	Flash- ing code	Test instructions/test conditions	Termi- nals	Set values
Ch.-air-pr. sen. Signal too high Signal too low	133	8	Voltage supply term. 1 (+) and term. 3 Test leads for open-circuit (op. circ.), short-circuit to ground and short-circuit to positive.  Measure voltage with connected charge-air-pressure sensor, term. 2 (+) and term. 3.	(CU1) 28,34, 35	4.5...5.5 V  Characteristic curve, see Coord.: 20
Con.-col.tvl.sen. Signal too high Signal too low	134	12	Connect test adapter KDEP 1165, adapter leads KDEP 1165/300 and -/301. Test voltage supply, socket 2 (+) and socket 3.  Measure resistance: sockets 2 and 3 as well as sockets 1 and 3  Test leads for open-circuit (op. circ.), short-circuit to ground and short-circuit to positive.  <u>Comparison not O.K.</u> Test prerequisites: engine-speed sensor, needle-motion sensor, computer communication interface O.K.  Test leads for open-circuit (see above). Visually inspect injected-quantity adjuster (safety instructions must be heeded).	(CU1) 6,10,29	4.5...5.5 V  1,0...3,0 k $\Omega$ 0,5...2,0 k $\Omega$
Supercharger Closed loop Faulty	135	9	Test pressure transformer: at 0...120°C Test supply voltage:  Test leads for open-circuit/contact resistance: Test routing of tubing (fuel-injection tubing), air filter for venting to atmosphere.  Test vacuum, hoses (visual inspection): Test function of bypass flap with Mityvac pump. Mechanical noise at turbocharger?	(CU 1) 1,25	4,5...8,0 $\Omega$ 12 V  > 500 mbar

## SELF-DIAGNOSIS TEST TABLE (continued)

Pocket system tester Fault indication	Fault code	Flash- ing code	Test instructions/test conditions	Termi- nals	Set values
Inj.-qty.adjust. Closed loop Faulty	136	10*	Test adapter KDEP 1165, adapter leads KDEP 1165/300 and -/301. Test contact resistance term. 4 and 7 - ground.  Measure resistance, injected-quantity adjuster, term. 4 and 7.  Test lead open-circuit, contact resistance, term. 4 and term. 7.	(CU2) 1,21	0,4... 0,7 $\Omega$
Needle-motion sensor Signal too high  Signal too low	142	11*	Measure resistance, needle-motion sensor (approx. 20°...80°C) Test leads for open-circuit (op. circ.), short-circuit to positive and short-circuit to ground.  Test contact resistance, terminal posts, needle-motion sensor - ground.	(CU1) 1,20	90... 135 $\Omega$
Start of inj. Closed-loop control Faulty	144	15	Measure resistance, solenoid valve: Test solenoid valve and leads for open-circuit (op. circ.), short-circuit to positive and short-circuit to ground.  Remove fuel-injection pump and test both supply pump pressure and timing-device profile.	(CU2) 1,2	14,3...17,3 $\Omega$
Interface Engine-speed signal Faulty	145	—	Test leads for open-circuit.	(CU 1) 8 (CU 2) 6	
Brake/brake safety switch Comparison not O.K.	146	—	Brake/brake safety switch (br./br. safety switch) Connect a multimeter to each circuit. Press brake pedal several times. Step response: Test voltage supply:        Test leads for open-circuit and contact resistance.	(CU 1) 5,11	infinity $\Omega$ to approx. 0 $\Omega$ 11,5...14,5 V

\* Serious fault, diagnosis lamp continuously lit

# TEST SPECIFICATIONS

Component/Function Set values

Idle speed (engine at operating temp., approx. 80° C):

	Vehicle not moving	Driving speed (>2 km/h)
Manual gear shift	750 min -1	820 min -1
Auto. transmission	750 min -1	750 min -1
A/C on	865 min -1	865 min -1

Engine cold 750...1045 min -1

Nozzle opening pressure: 150 + 8 bar

Pump/engine assignment:

Setting:

\* Engine setting: Cylinder 1 at TDC  
\* Pump setting: 1.05 mm after BDC

Check value:

\* Engine setting: Cylinder 1 at TDC  
\* Pump setting: 1.03 - 1.07 mm after BDC

Compression: 25...30 bar

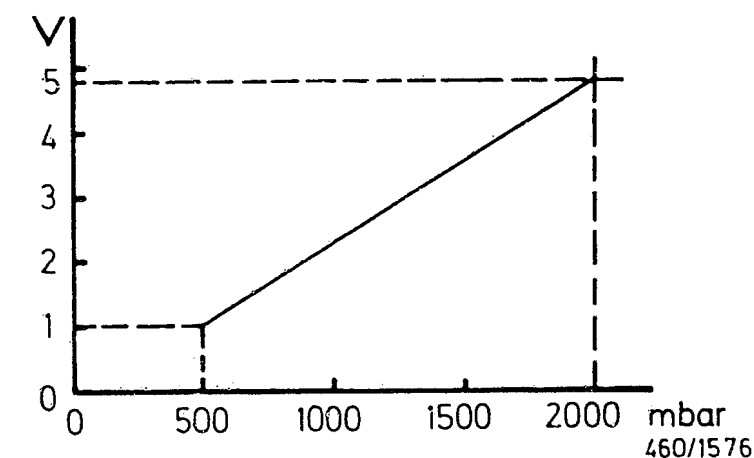
Max. cylinder deviation: 5 bar

Filter test; max. permissible  
difference in pressure: 0.3 bar

Pressure loss: max. perm. 25 %

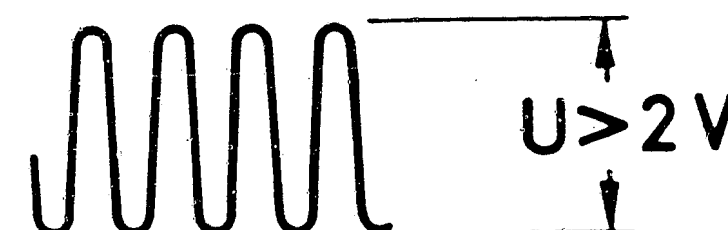
Vacuum, vacuum pump >500 mbar

Electropneum. switching valve  
(Resistance, EGR and RSC) 27...33 Ω



Charac. curve, charge-air-pres. sens.

Signal pattern, engine-speed sensor .

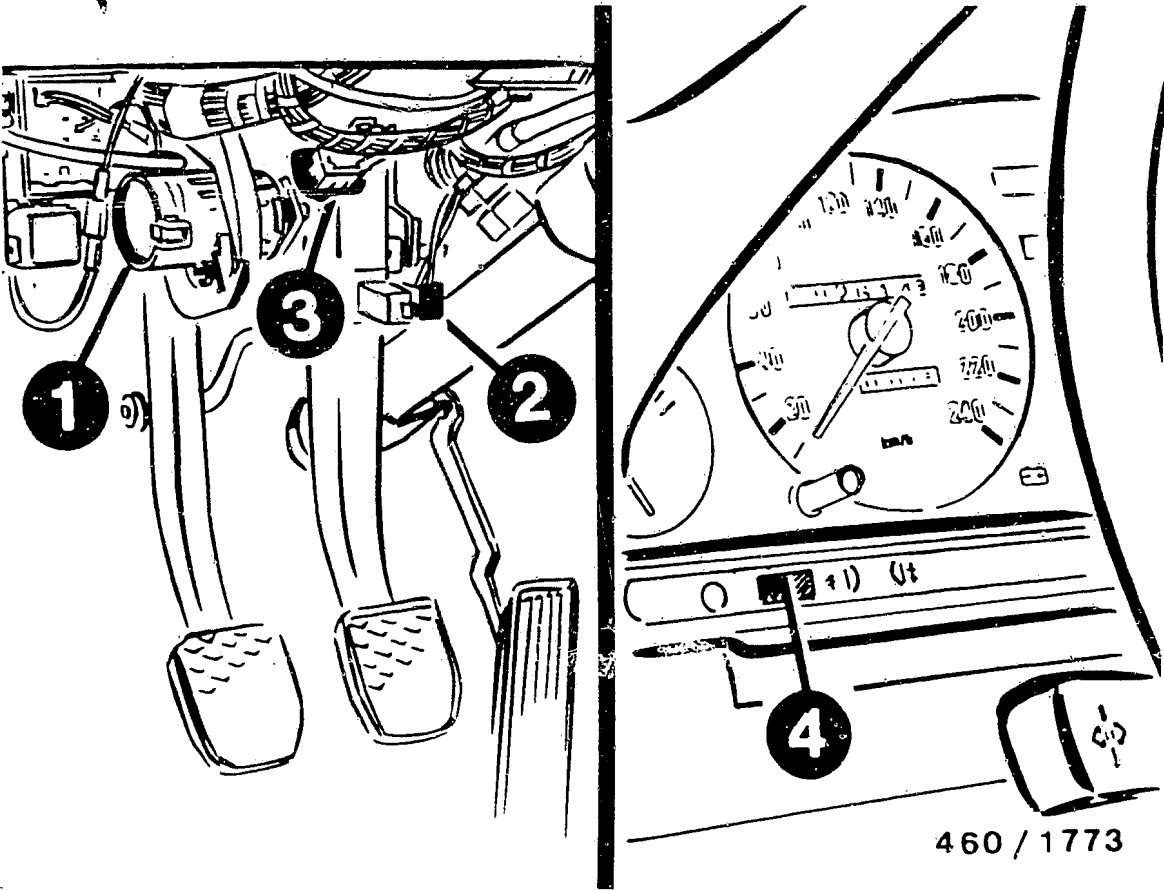


460/2015

TEST SPECIFICATIONS (CONTINUED)

Tightening torques

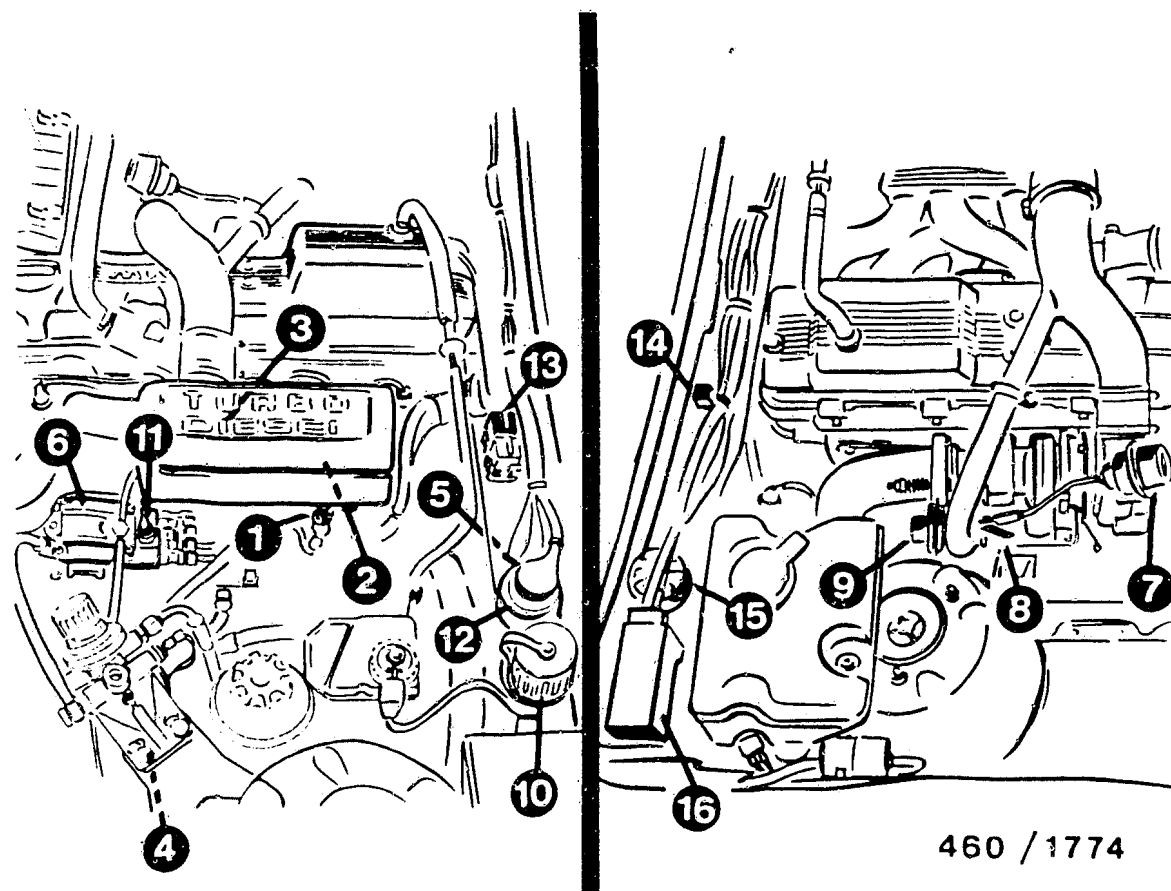
Fuel lines	25 Nm
Fastening screws, injection pump	20 Nm
Fastening screws, nozzle-holder assembly	40...45 Nm
Sheathed-element glow plugs	25 Nm
Screw plug	15 Nm
Cylinder-head-cover screws	7.5 Nm
Nut, injection-pump drive gear	45...50 Nm
Nut, camshaft gear	65...70 Nm
Tensioning-wheel mounting on engine (nut and bolt)	20...24 Nm
Toothed-belt pulley of jack shaft	55...65 Nm
V-belt pulley/vibration damper	22...24 Nm
Tensioning torque for tensioning- roller mounting (new toothed belt)	45...50 Nm
Tightening torque for tensioning- roller mounting (toothed-belt already run > 16 000 km)	30...35 Nm
Bleeder screw/thermostat housing	6...10 Nm



- 1 = Pedal-position sensor
- 2 = Brake/brake safety switch
- 3 = Switch, coupling
- 4 = Diagnosis lamp (in conjunction with indicator,  
water-level sensor)

INSTALLATION POSITION OF COMPONENTS

The road-speed pickup is attached to the differential housing.  
The control units are installed in the glove compartment.  
The electropneumatic switching valve is installed in the transmission; the transmission neutral switch is installed in the gear-shift console.

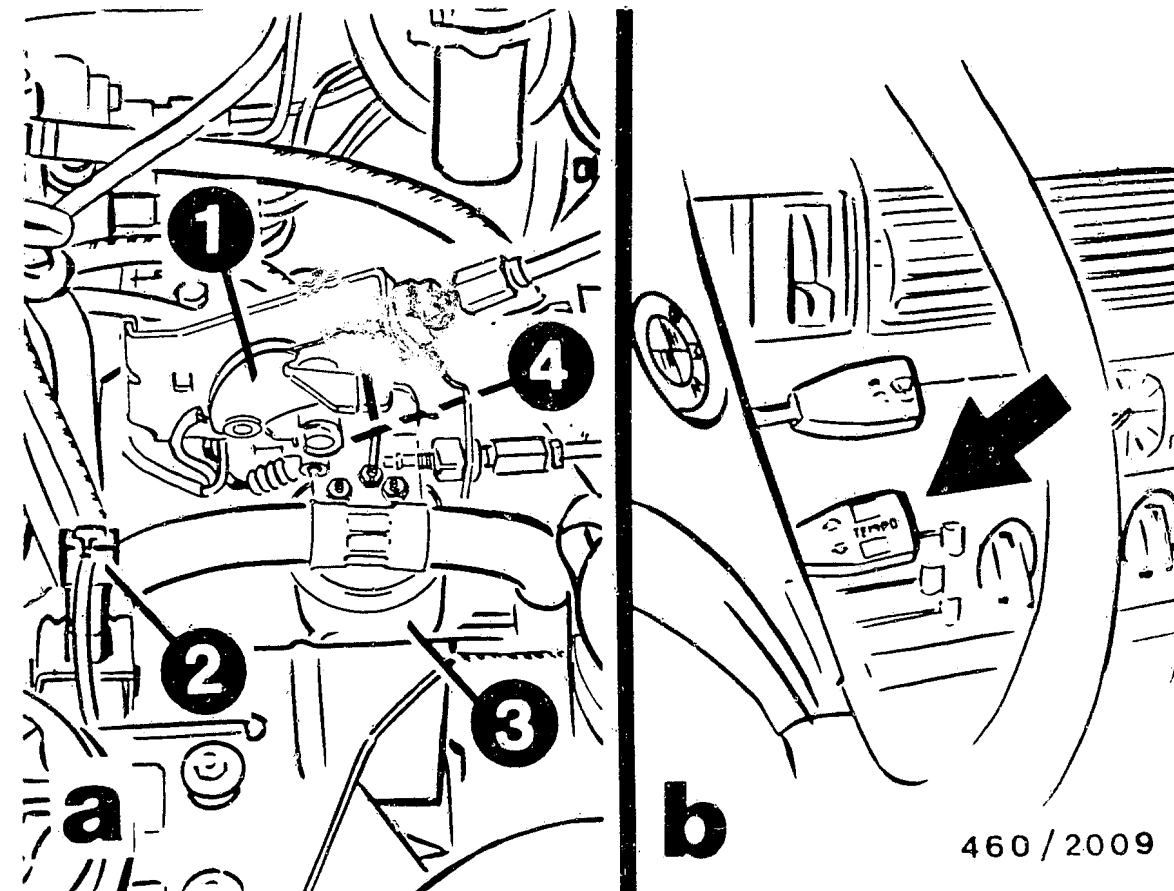


460 / 1774

- 1 = Air temperature sensor
- 2 = Engine temperature sensor
- 3 = Nozzle-holder assembly with NMS (cyl. 4)
- 4 = Charge-air-pressure sensor
- 5 = Engine-speed sensor
- 6 = Fuel-injection pump
- 7 = Control box (LDR)
- 8 = Bypass-flap actuator
- 9 = EGR valve
- 10 = Diagnosis plug
- 11 = Electric shutoff device
- 12 = Engine plug
- 13 = Reversed-polarity protection relay
- 14 = Electropneumatic switching valve (EGR)
- 15 = Electropneumatic pressure transformer (LDR)
- 16 = Glow-duration unit

#### INSTALLATION POSITION OF COMPONENTS (continued)

The solenoid-operated valve for start of injection and the fuel temperature sensor are installed in the fuel-injection pump.



460 / 2009

#### Vehicles with automatic transmission (Fig. a)

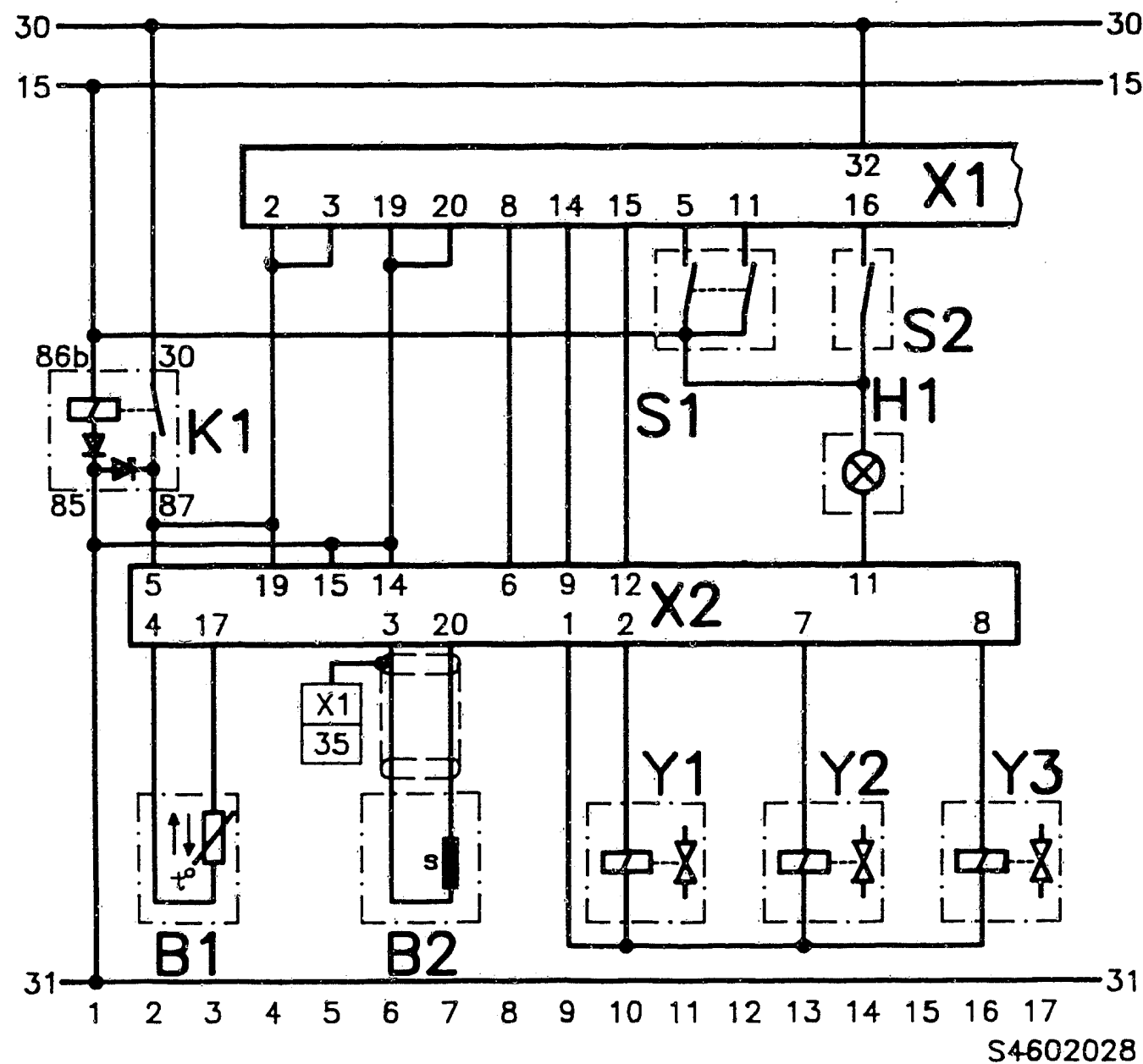
- 1 = Automatic transmission control
- 2 = Electropneumatic switching valve (RSC)
- 3 = Control box (RSC)
- 4 = Transmission indicator (not visible in picture)

The electropneumatic switching valve (downshift block) is installed in the transmission; the transmission neutral switch is installed in the gear-shift console.

Operating element, road-speed control  
(Picture b, arrow)

#### INSTALLATION POSITION OF COMPONENTS (continued)



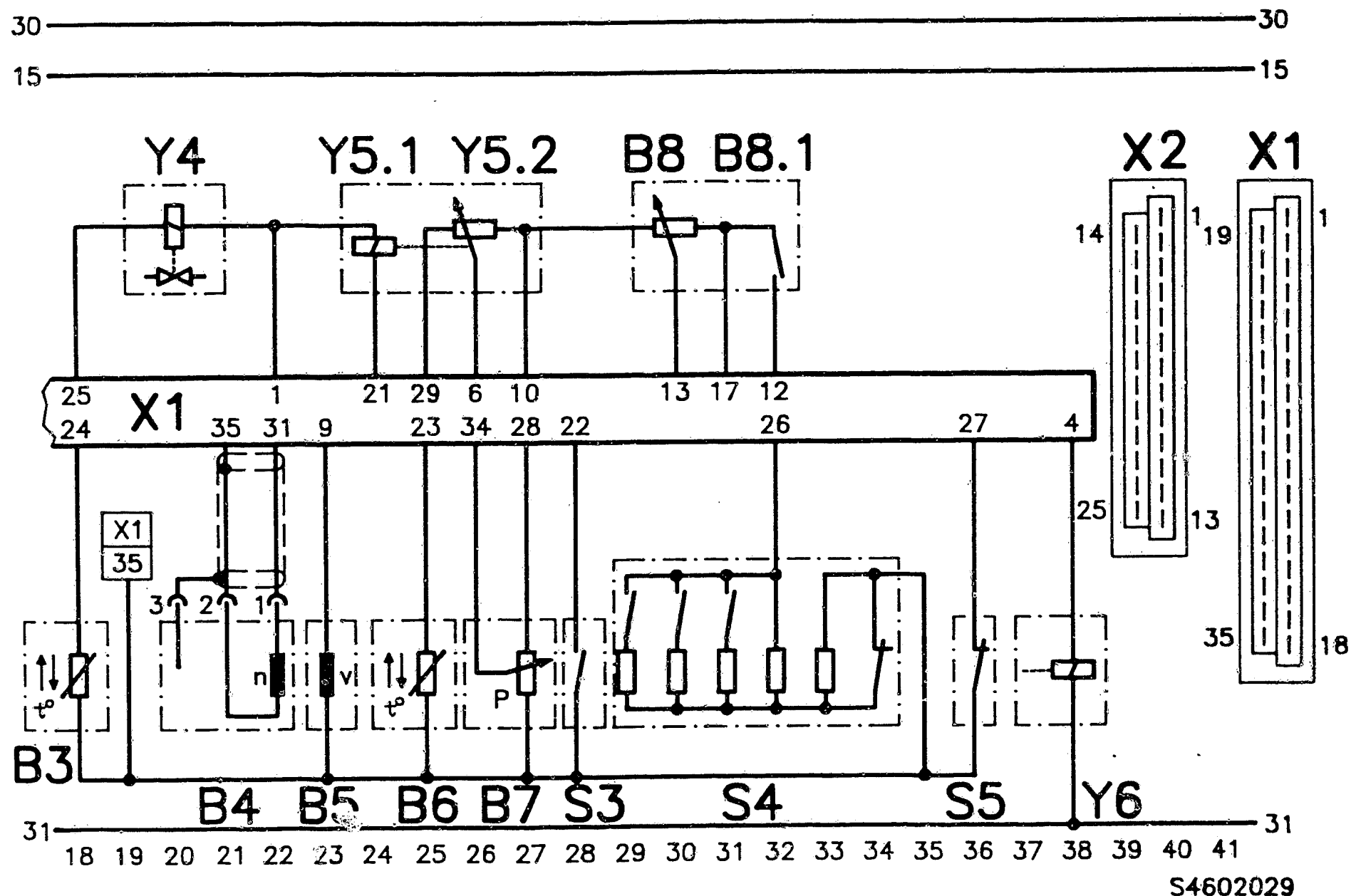


# ELECTRICAL TERMINAL DIAGRAM

B1 = Air temperature sensor  
 B2 = Needle-motion sensor  
 H1 = Diagnosis lamp  
 K1 = Reversed-polarity protection relay  
 S1 = Brake/brake safety switch  
 S2 = A/C switch  
 X1 = Control unit 1

X2 = Control unit 2  
 X3 = Diagnosis socket  
 Y1 = Solenoid-operated valve, start of injection  
 Y2 = Electropneumatic switching valve (EGR)  
 Y3\* = Electropneumatic switching valve

\* Only for vehicles with automatic transmission



# ELECTRICAL TERMINAL DIAGRAM (CONTINUED)

B3 = Fuel temperature sensor  
 B4 = Engine-speed sensor  
 B5 = Speed-signal sensor  
      (speedometer signal)  
 B6 = Engine temperature sensor  
 B7 = Charge-air-pressure sensor  
 B8 = Pedal-position sensor  
 B8.1 = Safety switch  
 S3 \* = Transmission indicator  
 S4 = Operating element, road-speed control

S5 = Switch, coupling (for vehicles with  
      automatic transmission, transmission  
      neutral switch)  
 X1 = Control unit 1  
 X2 = Control unit 2  
 Y4 = Electropneumatic pressure transformer  
      (boost-pressure control)  
 Y5.1 = Injected-quantity adjuster  
 Y5.2 = Control-collar travel sensor  
 Y6 = Electric shutoff device

(\* Only for vehicles with automatic transmission)

Trouble-shooting instructions: : ALF-5012  
BOSCH system : TC-I  
Make of vehicle : ALFA ROMEO  
Basic microcard : PKW-031

TABLE OF CONTENTS

Section	Coordinate
Special features, usage, safety.....	02
Trouble-shooting chart.....	04
Rapid diagnosis chart.....	05
Test specifications.....	13
Electrical terminal diagram.....	15
Installation position of components, removal and installation instructions.....	17

SPECIAL FEATURES

These brief instructions, valid at the time of publication, apply to the following Alfa-Romeo models:

Alfa 33 1.7 ie  
4-cyl. engine 9.87 →

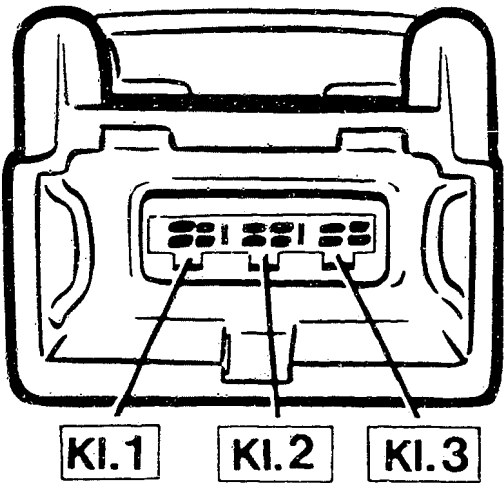
Alfa 33 with 1.2 / 1.3 / 1.5 / 1.7 l  
4-cyl. carburetor engine 9.87 →

- \* Ignition distributor 0 237 601 ... with fitted trigger box (TC-I).
- \* Trigger box 0 227 100 140  
or
- \* Trigger box 1 227 022 031  
(with current limitation).
- \* Ignition coil 0 221 122 323
- \* The set values indicated in these brief instructions apply only to Bosch products.



RAPID DIAGNOSIS CHART

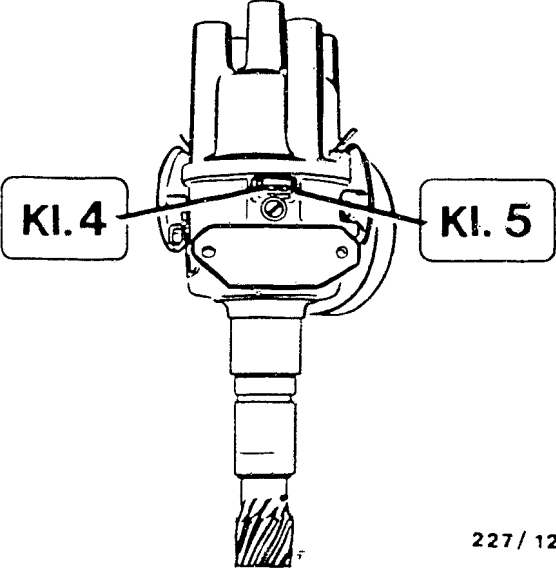
Test step	Testing of component/function Test instructions/conditions	Term.	Set values
1	HIGH-TENSION SIDE  Check spark plugs, ignition harness and distributor cap for example for proper functioning (e.g. open-circuit, shunt). Assess for example by way of ignition oscillogram, resistance measurement, visual inspection.	—	—
2	IGNITION COIL  Visual inspection: Plug present, sealing compound oozed out? Primary resistance Secondary resistance	<div>115</div> <div>14</div>	<div>0,6... 1,0 Ω</div> <div>6,4...11,1 k Ω</div>
3	VOLTAGE, TRIGGER BOX  Detach trigger-box plug. See picture. Ignition ON. Voltage, trigger-box plug.	<div>32</div> <div>(+)(-)</div>	Battery voltage
4	VOLTAGE, PRIMARY CIRCUIT  Trigger-box plug detached. See picture. Ignition ON. Voltage, trigger-box plug.	<div>12</div> <div>(+)(-)</div>	Battery voltage
5	MECHANICAL DAMAGE, MAGNETIC PULSE GENERATOR  Visual inspection: Timer core must not catch on teeth of magnetic pulse generator.	—	—



227/961

RAPID DIAGNOSIS CHART (CONTINUED)

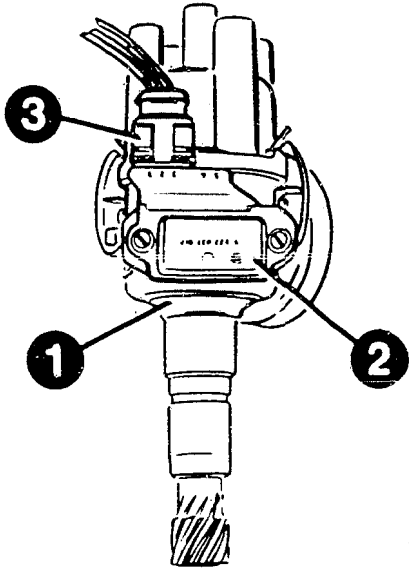
Test step	Testing of component/function Test instructions/conditions	Term.	Set values
6	INTERNAL RESISTANCE, MAGNETIC PULSE GENERATOR  Trigger box detached. See picture. Resistance, magnetic pulse generator.	4 5	270...475 Ω
7	INSULATION, MAGNETIC PULSE GENERATOR  Trigger box detached. See picture. Resistance, magnetic pulse generator and vehicle ground.	4 B-	infinity Ω
8	CONTACT RESISTANCE (PRIMARY SIDE)  Detach negative and positive lead of battery. Trigger-box plug detached.  Ignition ON. Resistance between battery terminal and trigger-box plug.  Resistance between battery terminal and ignition coil Resistance between ignition coil and trigger-box plug.	B+ 3 B- 2  E+ 15 1 1	max. 0.3 Ω  max. 0.3 Ω



227/1270

RAPID DIAGNOSIS CHART (CONTINUED)

Test step	Testing of component/function Test instructions/conditions	Term.	Set values
9	PRIMARY SIGNAL  Attach trigger box. Attach trigger-box plug. Oscilloscope/engine-speed tester at ign. coil.  Actuate starting motor.	15 1 (+) (-)	Primary voltage/ engine-speed reading (magnitude irrelev.)
10	IGNITION POINT AND IGNITION TIMING  Connect Motortester as per operating instructions.	—	see test specs. (e.g. Autodata)
11	VOLTAGE, TRIGGER BOX  Push back rubber sleeve of trigger-box plug. Voltage, trigger-box plug. See picture. Engine idling.	3 2 (+) (-)	12-14 V max; 1 V below U <sub>B</sub>



227 / 1271

- 1 = Ignition distributor
- 2 = Control unit
- 3 = 3-pole connector

# RAPID DIAGNOSIS CHART (CONTINUED)

Test step	Testing of component/function Test instructions/conditions	Term.	Set values
12	VOLTAGE, IGNITION COIL  Voltage, ignition coil and battery.  Engine idling.	15 B- (+) (-)	equal to/greater than 10 V
13	PEAK-COIL-CURRENT CUTOFF Only for trigger box 0 227 100 140  Voltage, ignition coil.  Ignition ON.	15 1 (+) (-)	After approx. 1 s 0 V
14	OUTPUT STAGE Only for trigger box 1 227 022 031  Voltage, ignition coil  Ignition ON.	15 1 (+) (-)	0 V
15	PRIMARY VOLTAGE  Oscill. with pulse-shaping circ. at ign. coil Engine idling. Trigger box 0 227 100 140 Trigger box 1 227 022 031	15 1 (+) (-)	290...400 V 290...370 V

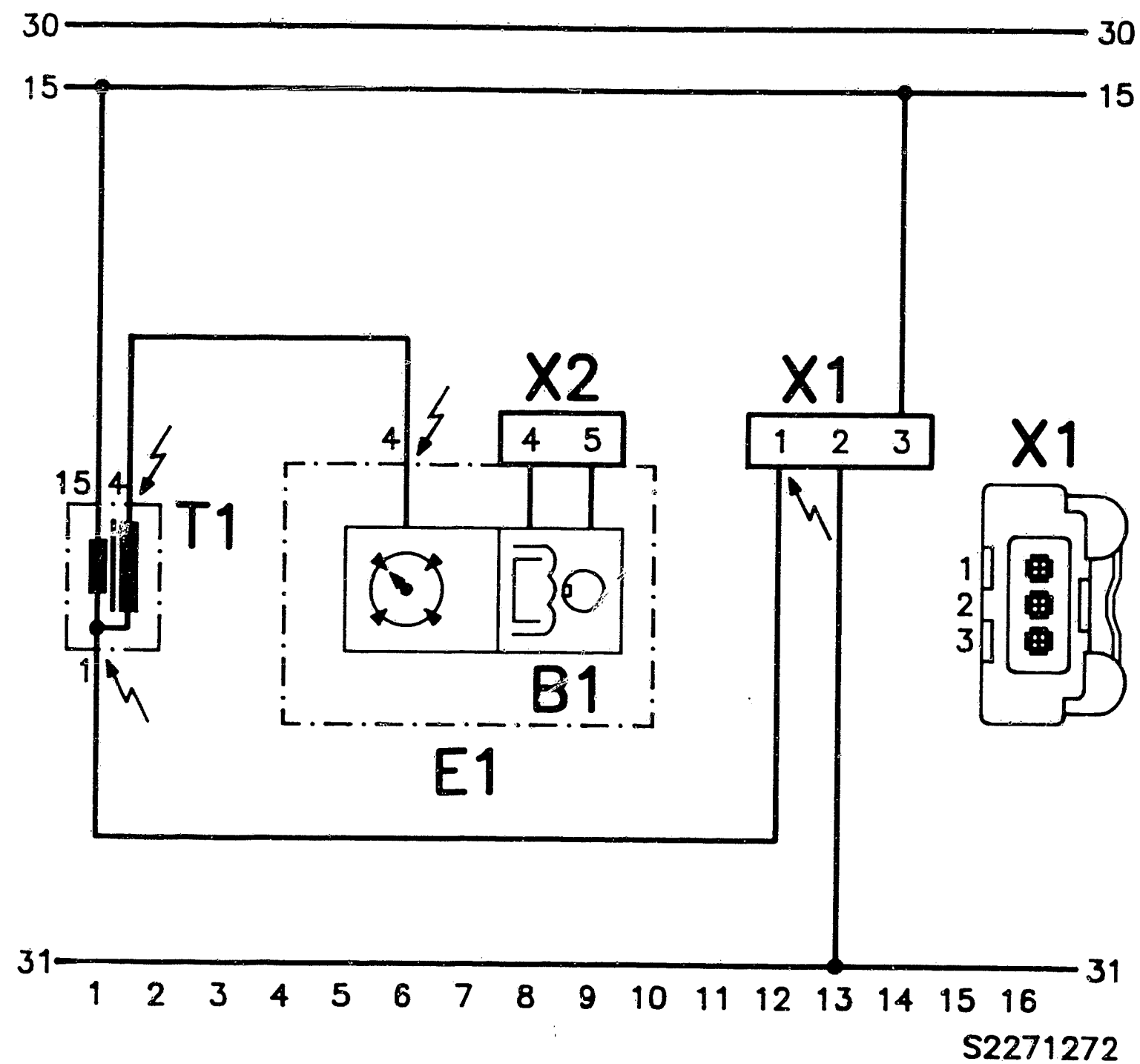


# TEST SPECIFICATIONS

Ignition coil, primary	0,6... 1,0 $\Omega$
Ignition coil, secondary	6,4...11,1 k $\Omega$
Voltage, trigger box with ignition ON	Battery voltage
Voltage, primary circuit with ignition ON	Battery voltage
Magnetic pulse generator	
Internal resistance	280...475 $\Omega$
Insulation	infinity $\Omega$
Contact resistance Supply leads, Trigger box/ Primary circuit	max. 0,3 $\Omega$
Primary signal at cranking speed	Primary voltage / Engine-speed reading
Ignition point and ignition timing	Test specs. e.g. Autodata
Voltage, trigger box with engine idling	12...14 V max. 1 V below U <sub>B</sub>
Voltage, ignition coil with engine idling	equal to/greater than 10 V
Primary voltage	
with engine idling	
Trigger box 0 227 100 140	290...400 V
Trigger box 1 227 022 031	290...370 V

Please refer to Autodata test specifications for settings  
as regards idle speed, exhaust gas, valve clearance etc.

For production reasons:  
continued on the following  
coordinate.



# ELECTRICAL TERMINAL DIAGRAM

High-tension arrows = hazardous voltages (400 V...25 kV)

B 1 = Inductive pickup

E 1 = Ignition distributor with inductive pickup  
and trigger box fitted

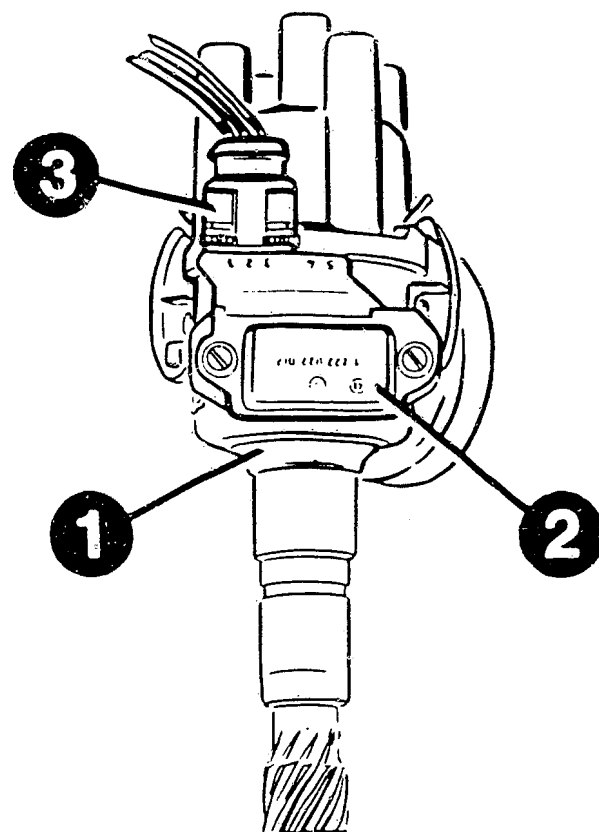
T 1 = Ignition coil

X 1 = Trigger-box plug

X 2 = Plug at trigger box

C15

C16



227/ 1271

- 1 = Ignition distributor
- 2 = Trigger box
- 3 = Three-pole connector

For production reasons:  
continued on the following  
coordinate.

#### INSTALLATION POSITION OF COMPONENTS

- \* Ignition distributor and trigger box, see top picture.
- \* Ignition coil is located in engine compartment at left-hand inner fender.

Trouble-shooting instructions : AUD-5004  
BOSCH system : KE-Jetronic 3.2  
Make of vehicle : AUDI  
Basic microcard : PKW-065

## TABLE OF CONTENTS

Section	Coordinates
Special features .....	02
Structure, usage .....	02
Self-diagnosis as of model 1989 .....	03
Trouble-shooting chart.....	05
Self-diagnosis test table .....	07
Test specifications .....	15
Electrical terminal diagram .....	23
Installation position of components, removal and installation instructions .....	25

## SPECIAL FEATURES

\* These instructions contain KE-Jetronic trouble-shooting for the following Audi models valid at the time of writing:

AUDI 100, 100 Quattro  
Engine NF / 2.3 l / 5 cylinder 06.86->

Audi 90, 90 Quattro  
Engine NG / 2.3 l / 5 cylinder 04.87->

- \* KE-Jetronic system version 3.2 with self-diagnosis and flashing-code output
- \* Final-controlling-element diagnosis
- \* Tank ventilation with timed valve
- \* Lambda closed-loop control
- \* In-tank electric fuel pump in AUDI 100 model
- \* Electronic ignition with knock control, self-diagnosis and flashing-code output

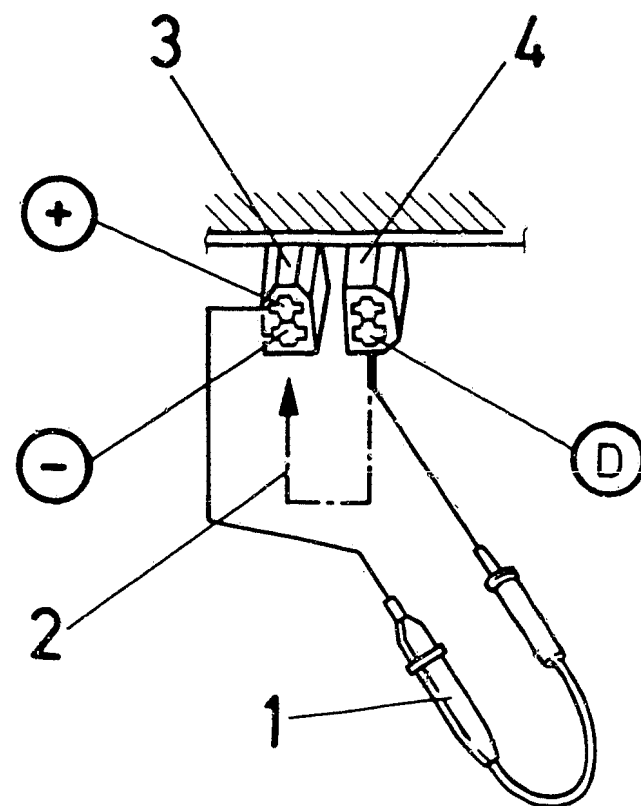
## STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.  
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

Pay attention to safety measures and precautions outlined in basic instructions, so as to avoid injury and prevent damage to engine, trigger boxes, control units, components and ignition system.



438/1776

- 1 = Diode test lamp
- 2 = Jumpering lead (for triggering diagnosis)
- 3 = Diagnosis plug, black
- 4 = Diagnosis plug, brown (D = Diagnosis lead)

#### SELF-DIAGNOSIS AS OF MODEL 1989

The self-diagnosis has been modified as follows as of model year 1989:

- \* No fault lamp in dash panel insert.
- \* Self-diagnosis can no longer be activated at fuel-pump relay.

Instead, two diagnosis plugs for the connection of a diode test lamp and a diagnosis triggering lead (see picture) are provided on the driver's side in the footwell above the pedals.

#### SELF-DIAGNOSIS AS OF MODEL 1989 (CONTINUED)

The diode test lamp serves as diagnosis indicator lamp and is connected to the positive connection of the black plug and to the diagnosis connection of the brown plug (picture).

To activate the self-diagnosis, the diagnosis connection of the brown plug is connected for at least 4 seconds with the jumpering lead to the ground connection of the black plug and then disconnected again.

Otherwise the self-diagnosis system and the procedure for fault determination are exactly the same as that described in the basic microcard.

## TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts, but dies again.
3. Rough idling (engine speed, exhaust gas).
4. Poor throttle response, flat spot during acceleration.
5. Engine misfiring (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

Cause (component fault)

*	*	*	*	*	*	*	*			*	Self-diagnosis
*	*	*	*	*	*	*		*	*		Pressure actuator
		*									Tank-vent valve
		*									Idle actuator
*		*				*					Cold-start valve
*		*	*		*						Intake system
*	*	*	*					*			Air-flow sensor
*								*			Air-flow sensor plate
*	*			*	*						Electric fuel pump
*	*			*	*						Primary pressure
*	*	*	*	*	*	*					Differential pressure
*											Fuel system leaking
*	*	*	*	*	*			*			Injection valves
*	*	*	*		*	*					Fuel distributor

## TROUBLE-SHOOTING CHART (CONTINUED)

Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts, but dies again.
3. Rough idling (engine speed, exhaust gas).
4. Poor throttle response, flat spot during acceleration.
5. Engine misfiring (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

|Cause (component fault)

*		*		*				Throttle valve
*	*	*	*	*		*	*	Voltage supply, control unit
*	*	*	*	*	*			Temperature sensor (coolant)
		*	*					Throttle-valve switch, idle
				*		*	*	Throttle-valve switch, full load
		*	*	*				Lambda closed-loop control
*	*	*	*		*			Exhaust-gas adjustment
		*						Low-idle-speed control
*								Starting enrichment
	*							Post-starting enrichment
	*	*	*					Warm-up enrichment
			*					Acceleration enrichment
		*	*					Full-load enrichment
				*				Overrun cut-off

# SELF-DIAGNOSIS TEST TABLE

Fault indication Flashing code	Checking of component/function	Test instructions/ Test conditions	Term- inals	Set values
1 1 1 1	Control units	Watch whether fault-code output concerns EI-K or KE! EI-K control unit or KE control unit faulty.		
2 1 2 1	Throttle-valve switch, idle or cable faulty	Watch whether fault-code output concerns EI-K or KE! Throttle-valve switch, idle, permanently closed. Cable to terminal 28 has short circuit to positive. Setting incorrect. Throttle valve closed: Throttle valve open: Check setting:	KE 28 EI-K 7	0 $\Omega$ infinity $\Omega$ 0.6 mm
2 1 2 2	No engine-speed signal from ignition system	Lead from KE control unit terminal 30 to EI-K control unit terminal 17 interrupted. Check lead for continuity: Check ignition system: see SIS overview (KFZ 00.)	KE 30 EI-K 17	0 $\Omega$
2 1 2 3	Throttle-valve switch, full load or cable faulty	Watch whether fault-code output concerns EI-K or KE! Throttle-valve switch, full load, permanently closed. Cable to terminal 28 has short circuit to positive. Setting incorrect. Throttle valve closed: Throttle valve open: Check setting:	KE 31 EI-K 9	infinity $\Omega$ 0 $\Omega$ 68...76°
2 1 4 1	Knock control at control stop	Check ignition system: see SIS overview (KFZ 00.)		
2 1 4 2	Knock sensor or cable faulty	Check ignition system: see SIS overview (KFZ 00.)		

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Fault indication Flashing code	Checking of component/function	Test instructions/ Test conditions	Term- inals	Set values
2 2 2 3	Altitude sensor or cable faulty	Watch whether fault-code output concerns EI-K or KE! Check voltage supply to altitude sensor at terminals 2 and 3. Check voltage signal at terminals 1 and 3. Open circuit. Check cable for continuity:	KE 25, 26,35 EI-K 2	4.35...5.35 V see test specifications 0 $\Omega$
2 2 3 2	Potentiometer at air-flow sensor or cable faulty	Check voltage supply to potentiometer at terminals 1 and 3. Check voltage signal at terminals 1 and 2.  Open circuit. Check cable for continuity:	KE 23, 26,35	4.35...5.35 V Voltage rise, max. 5.35 V 0 $\Omega$
2 2 3 3	Reference voltage for load and altitude signal for EI-K control unit	Cable from KE control unit terminal 26 to EI-K control unit terminal 21 interrupted. Check cable for continuity:	KE 26 EI-K 21	0 $\Omega$
2 3 1 2	Temperature sensor (engine) or cable faulty (double NTC, one connection for KE-Jetronic)	Watch whether fault-code output concerns EI-K or KE! Cable from KE control unit terminal 3 to temperature sensor (engine) interrupted or short circuit to ground. Check cable for continuity:  Check cables for short circuit to ground:  Resistance value, temperature sensor (engine)  * Engine cold (+15°C...+30°C)  * Engine at operating temperature (approx. +80°C)	KE 3	0 $\Omega$  infinity $\Omega$  1300...3600 $\Omega$  250... 390 $\Omega$



## SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Fault indication Flashing code	Checking of component/function	Test instructions/ Test conditions	Termi- nals	Set values
2 3 4 1	Lambda closed-loop control outside working range (control limits exceeded or not reached)	<p>Fault occurs only when idling or in part-load range. Fault detection at the earliest 6 minutes after starting.</p> <p>Possible causes of trouble:</p> <ul style="list-style-type: none"> <li>* No or incorrect lambda closed-loop control function, short-circuit in sensor lead, defective lambda-sensor heater.</li> <li>* Start valve leaking.</li> <li>* Intake system leaking (leakage air).</li> <li>* Tank ventilation valve permanently open.</li> <li>* Incorrect idle-speed adjustment.</li> </ul>	— —	— —
2 3 4 2	Lambda sensor or lead defective	<p>Open-circuit in lead from KE-control unit, term. 7 to lambda sensor, short-circuited to ground or battery voltage</p> <ul style="list-style-type: none"> <li>* Test lead continuity:</li> <li>* Test short-circuit of leads to ground and battery voltage: Watch out for worn cable insulation!</li> <li>* Sensor heater defective. Resistance value:</li> <li>* Sensor clogged.</li> </ul>	KE 7	<p>0 <math>\Omega</math></p> <p>infinity <math>\Omega</math></p> <p>1...15 <math>\Omega</math></p>

## SELF-DIAGNOSIS TEST TABLE (CONTINUED)

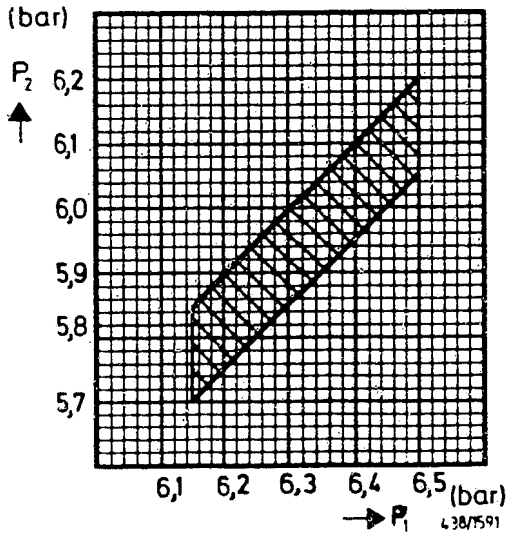
Fault indication Flashing code	Checking of component/function	Test instructions/ Test conditions	Termi- nals	Set values
4 4 3 1	Idle actuator or lead defective	Open-circuit in lead from KE-control unit, term. 17 to idle actuator or short-circuit to ground.  Open-circuit in voltage supply (ignition term. 15) to idle actuator.  * Test lead continuity:  * Test short-circuit of leads to ground:	KE 17	Battery voltage  0 $\Omega$  infinity $\Omega$
4 4 4 4	No fault present			
0 0 0 0	End of fault output			

## TEST SPECIFICATIONS

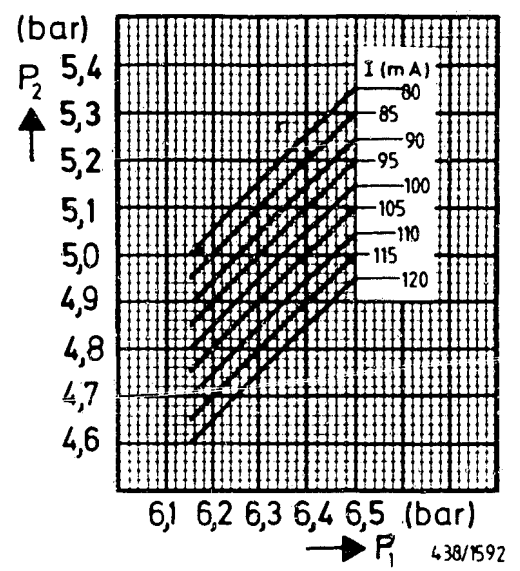
No.	Testing/Test conditions	Set value
1	Engine-speed signal from EI-K control unit to KE control unit:	approx. 5,0 V
2	Supply voltage for altitude sensor:  Voltage signal from altitude sensor: <div>Sea level 500 m 1000 m 1500 m 2000 m 3000 m</div>	4,35...5,35 V   3,2...4,7 V 2,8...4,0 V 2,4...3,5 V 2,0...3,0 V 1,5...2,5 V 0,8...1,6 V
3	Supply voltage for potentiometer on air-flow sensor:  Voltage signal from potentiometer: air-flow sensor plate in neutral position air-flow sensor plate deflected	4,35...5,35 V  5,35 V max. 21 V
4	Resistance value, temperature sensor (coolant): engine cold (+15°C...+30°C) Engine at normal operating temperature (approx. 80°C)	1300...3600 $\Omega$ 250... 390 $\Omega$
5	Lambda closed-loop control: open-loop control operation  closed-loop control operation  rich stop lean stop	-1...+1 mA (static) -1...+1 mA (pulsating) max. +10 mA max. -10 mA
6	Resistance value, pressure actuator:	16...22 $\Omega$
7	Resistance value, tank-vent valve:	35...55 $\Omega$
8	Resistance value, idle actuator:	4...12 $\Omega$
9	Resistance value, cold-start valve:	6...14 $\Omega$

# TEST SPECIFICATIONS (CONTINUED)

No.	Test/test condition	Set value	
10	Position of air-flow sensor plate (zero position) beneath basic position:	1,9...3,0 mm	
11	Air-flow sensor plate idle motion:	0,1...2,0 mm	
12	Electric fuel pump – fuel delivery: Supply voltage (under load):	min. 1160 cm <sup>3</sup> /min min. 11,5 V	
13	Fuel distributor – primary pressure:	6,15...6,5 bar	
14	Differential pressure  Take lower-chamber pressure "warm" set value in accordance with measured primary pressure from upper diagram (actuator current = 0 mA)  Take lower-chamber pressure "cold" set value in accordance with measured primary pressure and actuator current from lower diagram. Simulation of "cold" state: switch on ignition (closed-circuit current approx. 100 mA)		
15	Leakage test for entire system:  Minimum pressure after 10 min.: Minimum pressure after 20 min.:	3,3 bar 3,2 bar	
16	Opening pressure of injection valves:	3,7...4,8 bar	
17	Comparative fuel-delivery measurement: Actuator current: 0A  Idle: Part load: Full load:  Minimum quantity at max. deflection of air-flow sensor plate:	Setting:	Max. perm. quantity:
		(cm <sup>3</sup> /min)	(cm <sup>3</sup> /min)
		6,0 40,0 100,0  125,0 cm <sup>3</sup> /min	6,6 42,5 109,0



P 1 = Primary pressure ure  
P 2 = Lower-chamber pressure .  
I = Actuator r current



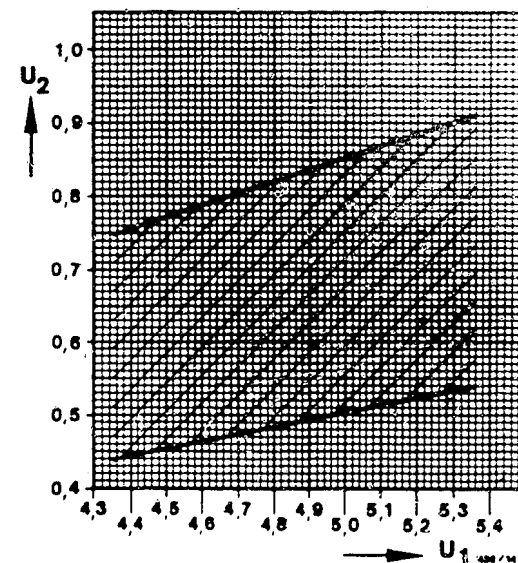
TEST SPECIFICATIONS (CONTINUED)

No.	Test/Test conditions	Set value		
18	Flow rate, KE-throttle	130...150 cm3/min		
19	Control-unit functions:	Control unit:		
		0 280 800 165 166	0 280 800 223 224	0 280 800 252 253
	Starting enrichment (corresponds to 20°C)	90...110 mA	90...110 mA	14...34 mA
	Post-start enrichment (corresponds to 20°C)	20... 30 mA	23... 34 mA	24...35 mA
	Warm-up enrichment (corresponds to 20°C*)	10... 15 mA	11... 18 mA	10...17 mA
	Acceleration enrichment (corresponds to 20°C) Slowly increase engine speed	Current value increases		
	Full-load enrichment (corresponds to engine at operating temperature)	4... 8 mA	5... 12 mA	5...12 mA
	Overrun cutoff (corresponds to engine at operating temperature)	-40...-60 mA	-40...-60 mA	-40...-60 mA

\*) Keep measurement time as short as possible, so as to protect catalytic converter  
Avoid overenrichment.

## TEST SPECIFICATIONS (CONTINUED)

No.	Test/Test condition	Set value
20	<p>Idle-speed adjustment *)</p> <p>+ Idle speed (regulated)      NF engine:   NG engine:</p> <p>+ CO content: - Lambda sensor detached, test value :    Setting:</p> <p>- Lambda sensor connected:</p> <p>- Pressure regulator current:</p>	<p>670...770 min -1 720...860 min -1</p> <p>0,3...3,0 vol. % 0,6...1,0 vol. %</p> <p>0,3...2,0 vol. % - 1...+ 1 mA</p>
21	<p>Signal, potentiometer, air-flow sensor (Measurement only required in the event of poor idle/part-load performance).</p> <p>+ Measure and note down supply voltage at potentiometer, term. 1(+) and 3(-):</p> <p>+ Measure voltage signal from potentiometer term. 2(+) and 3(-) with engine at operating temperature and at idle speed and compare with set value from adjacent graph.</p>	<p>4,35...5,35 V</p> <p>See graph</p>



$U_1$  = Supply voltage,  
potentiometer

U<sub>2</sub> = Potentiometer  
voltage signal

\*) Notes on idle-speed adjustment:

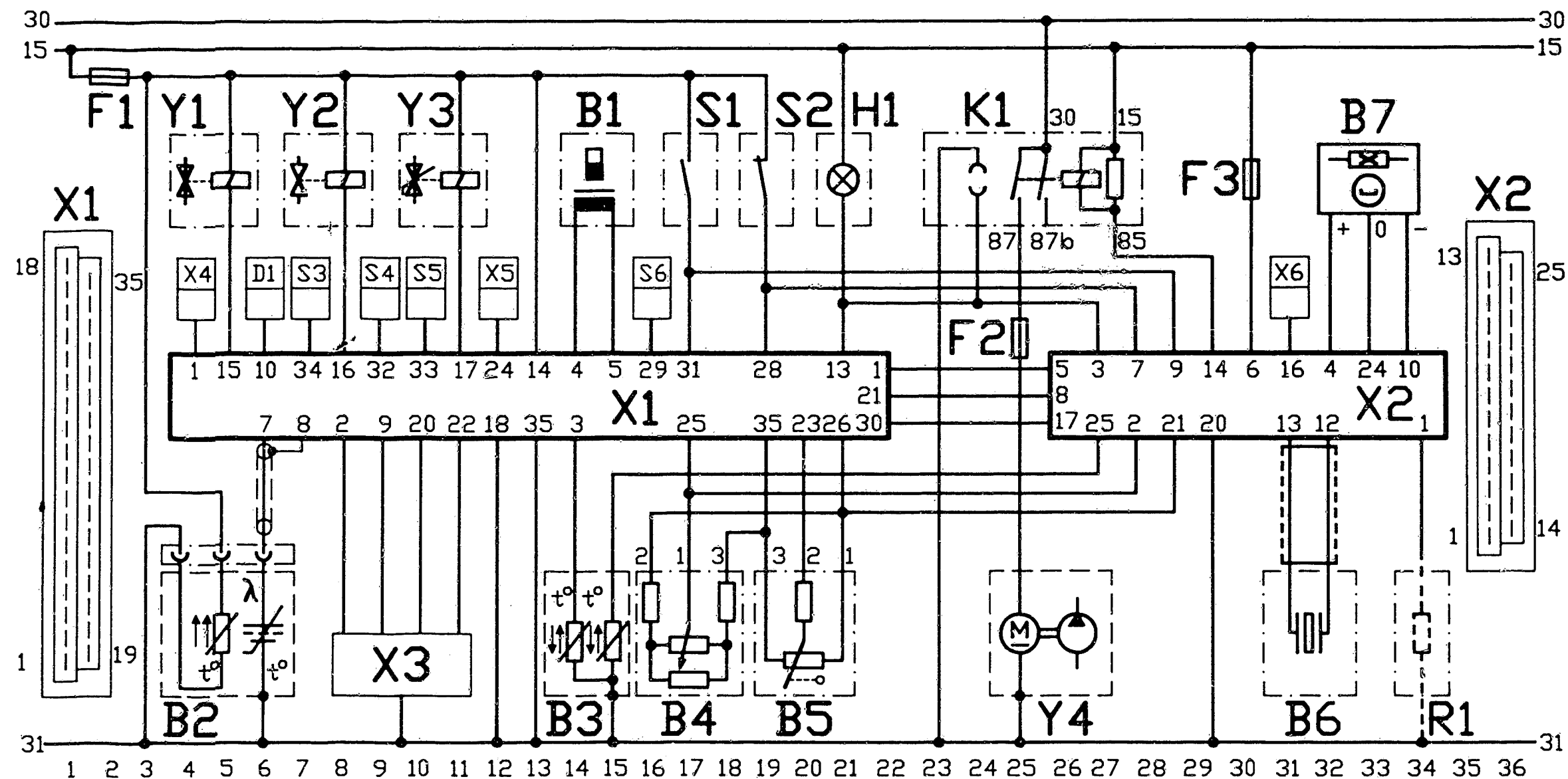
The regulated idle speed cannot be adjusted.

CO-adjustment conditions:

+ Engine oil temperature min. 80° C.

+ Hose for crankcase breather detached and sealed.

+ Detach hose to active-carbon filter at air scoop (angle piece remains open in scoop).



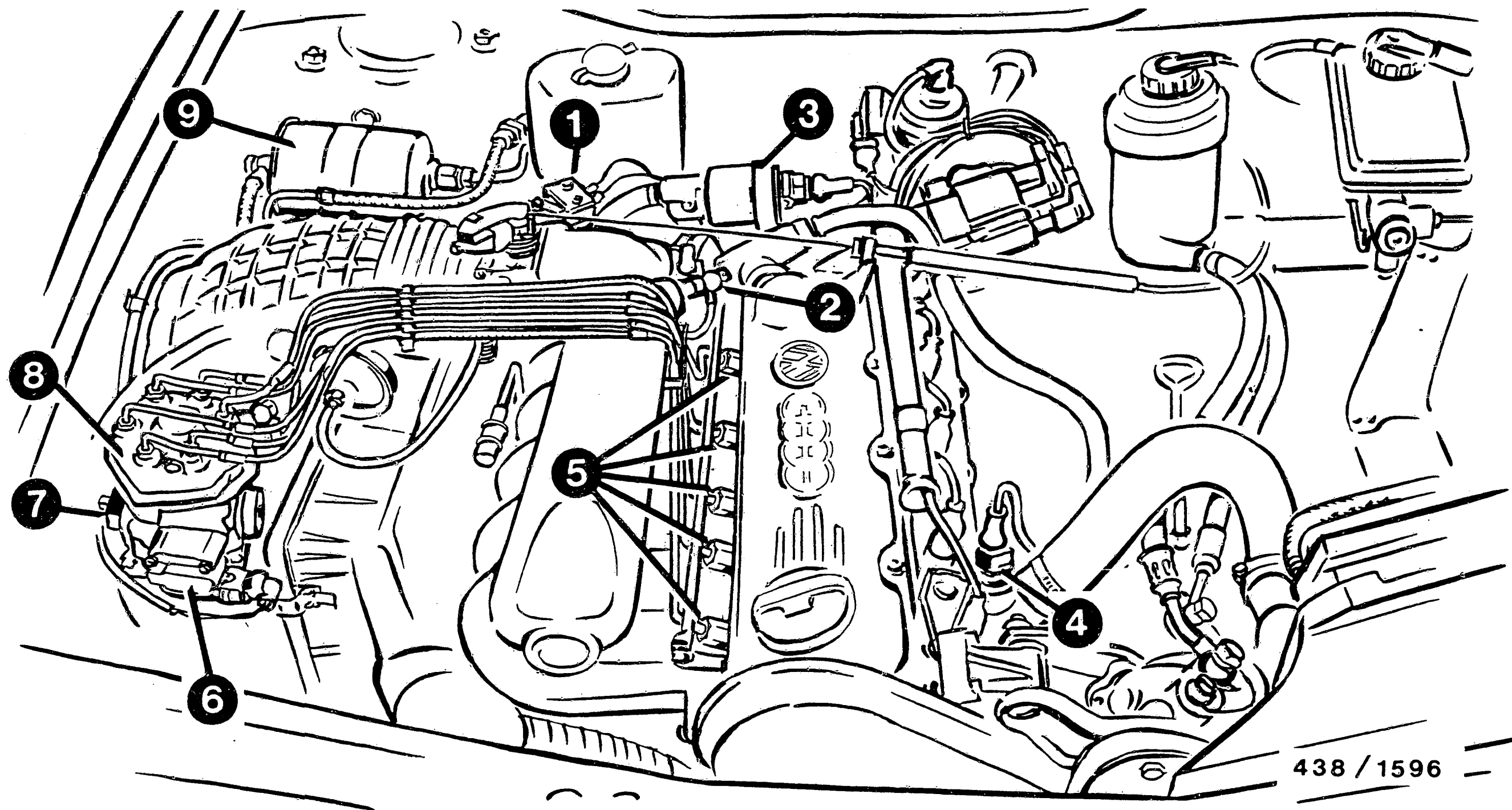
438/1593

# ELECTRICAL TERMINAL DIAGRAM

B1 = Pressure actuator  
 B2 = Lambda sensor  
 B3 = Temperature sensor (coolant)  
 B4 = Altitude sensor  
 B5 = Air-flow sensor potentiometer  
 B6 = Knock sensor  
 E1 = Ignition distributor  
 F1 = 10 A fuse  
 F2 = 8 A fuse  
 H1 = Diagnostic lamp

K1 = Electric-fuel-pump relay  
 R1 = Resistance, variant encoding  
 S1 = Full-load throttle-valve switch  
 S2 = Idle throttle-valve switch  
 T1 = Ignition coil  
 U1 = Connection, diagnosis interface  
 U2 = Connection, on-board computer  
 U3 = Connection, transmission switch  
 (in vehicles with man. shifted trans. to ground)  
 U4 = Connection, air-conditioner readiness for op.

U5 = Connection, air-cond. compress.  
 U6 = Connection, idle encoding  
 U7 = Connec., overrun cut-off supp.  
 X1 = Plug, KE control unit  
 X2 = Plug, EI-K control unit  
 X3 = Plug, parameter encoding  
 Y1 = Tank-vent valve  
 Y2 = Cold-start valve  
 Y3 = Idle actuator  
 Y4 = Electric fuel pump



438 / 1596

# INSTALLATION POSITION OF COMPONENTS (in picture: AUDI 100)

- 1 = Throttle-valve switch (full load).  
The throttle-valve switch, idle (not visible in picture) is located on the underside of the throttle-valve assembly.
- 2 = Start valve
- 3 = Idle actuator

- 4 = Temperature sensor (engine)
- 5 = Injection valves
- 6 = Pressure actuator
- 7 = Potentiometer at air-flow sensor
- 8 = Fuel distributor
- 9 = Fuel filter



# INSTALLATION POSITION OF COMPONENTS (CONTINUED)

## AUDI 100:

- \* EI-K control unit:  
In driver's footwell.
- \* Altitude sensor:  
Above the EI-K control unit.  
The components are accessible when the shelf, the unlocking mechanism for the engine-compartment hood and the side covering are removed.
- \* KE control unit:  
In passenger's footwell. The control unit is accessible when the shelf and side covering are removed.
- \* Fuel accumulator:  
On vehicle underbody between rear axle and fuel tank.
- \* Pressure regulator:  
Next to mixture-control unit in right-hand wheel arch.
- \* Activated-carbon filter with tank-ventilation valve:  
Next to mixture-control unit in right-hand wheel arch.
- \* In-tank electric fuel pump:  
Accessible from the luggage compartment.  
For removal, take away luggage-compartment mat and unscrew round closing cover (3 screws).
- \* Catalytic converter and lambda sensor:  
In exhaust system, in the region behind the front axle.

# INSTALLATION POSITION OF COMPONENTS (CONTINUED)

## AUDI 90:

- \* EI-K control unit:  
To the side in passenger's footwell, accessible when side panelling is removed.
- \* Altitude sensor:  
Above EI-K control unit.
- \* KE control unit:  
Behind the glove box, accessible when the lower panelling is removed.  
(2 screws).
- \* Injection valves:  
Fitted as in AUDI 100, but access is difficult due to different configuration of intake manifold.  
To improve accessibility, disconnect intake manifold at individual tubes.
- \* Components of fuel-supply system:  
Electric fuel pump, fuel accumulator and fuel filter are on vehicle underside, in the region in front of the rear axle.
- \* Catalytic converter and lambda sensor:  
In exhaust system in the region behind the front axle.
- \* Activated-carbon filter:  
On left-hand wheel arch; the tank-ventilation valve on the airscoop of the air-flow sensor.

Trouble-shooting instructions : AUD-5015  
BOSCH system : KE-Jetronic 2.5  
Make of vehicle : AUDI  
Basic microcard : PKW-097

## TABLE OF CONTENTS

Section	Coordinates
Special features .....	02
Structure, usage .....	02
Trouble-shooting chart .....	03
Test specifications .....	05
Rapid diagnosis chart .....	12
Electrical terminal diagram .....	23
Diagram of air and fuel lines .....	25
Installation position of components, removal and installation instructions .....	27

## SPECIAL FEATURES

These trouble-shooting instructions, valid at the time of publication, apply to the following vehicle models:

AUDI 90 04.87->  
with 2.0 l / 5-cylinder engine  
85 kW (115 bhp)  
Engine code letters PS

- \* KE 2.5 - Jetronic
- \* Lambda closed-loop control
- \* Idle-speed regulation
- \* Overrun cutoff
- \* Injection valves with fixed air guiding cap.  
Connection of injected-quantity comparison  
unit with adapter sleeves KDJE-P 200/19.

## STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.  
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

Pay attention to safety measures and precautions outlined in basic instructions, so as to avoid injury and prevent damage to engine, trigger boxes, control units, components and ignition system.

TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

- Starting motor operates, engine fails to start or starts only with difficulty.
- Engine starts but then dies.
- Idle problems (engine speed, exhaust gas).
- Poor throttle take-up, flat spot during acceleration.
- Engine missing (ignition, injection).
- Maximum engine power/top speed not reached.
- Fuel consumption too high.
- Engine running on (dieseling).
- Engine pinging/knocking.
- Engine overheating.

Cause (component fault)									
*	*	*	*	*					Intake system
*	*	*	*	*	*	*			Air-flow sensor
*						*			Sensor plate
*	*			*	*				Electric fuel pump
*				*					System pressure
*	*	*	*	*	*			*	Differential pressure
*									Leak in fuel system
*	*	*	*	*	*		*		Injection valves
*	*	*	*	*					Fuel distributor
		*			*				Throttle valve
*	*					*	*		Cold-start system
*	*	*	*	*				*	System voltage
									Control unit
*	*	*			*	*			Temperature sensor (engine)
		*	*						Throttle-valve switch
									Idle
					*	*		*	Throttle-valve switch
									Full load

TROUBLE-SHOOTING CHART (CONTINUED)

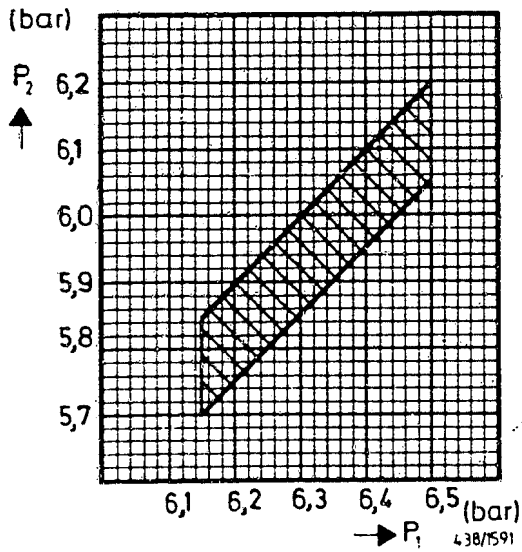
Customer complaint (fault symptoms)

- Starting motor operates, engine fails to start or starts only with difficulty.
- Engine starts but then dies.
- Idle problems (engine speed, exhaust gas).
- Poor throttle take-up, flat spot during acceleration.
- Engine missing (ignition, injection).
- Maximum engine power/top speed not reached.
- Fuel consumption too high.
- Engine running on (dieseling).
- Engine pinging/knocking.
- Engine overheating.

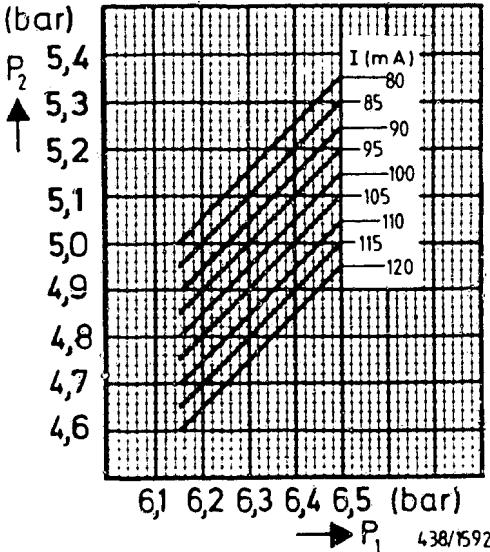
Cause (component fault)									
		*	*	*	*	*	*	*	Lambda closed-loop control
*	*	*	*	*	*	*		*	Exhaust-gas setting
		*							Idle-speed regulation
			*						Air-flow sensor
									Potentiometer
*									Starting enrichment
*	*								Post-start enrichment
	*	*	*						Warm-up enrichment
			*						Acceleration enrichment
					*			*	Full-load enrichment
					*				Overrun cutoff

TEST SPECIFICATIONS

No.	Test/Test condition	Test specification	
1	Electric fuel pump - delivery quantity:	min. 1000 cm <sup>3</sup> /min	
2	Primary pressure:	6,15...6,5 bar	
3	Differential pressure:  Get lower-chamber pressure "warm" nominal value from the upper diagram corresponding to the measured primary press. (actuator current 10mA).  Get the lower-chamber "cold" nominal pressure from the lower diagram corresponding to the measured primary pressure and actuator current.  Tolerance ± 0.15 bar.  Simulation of the "cold" state: pull the cable plug on the engine temperature sensor.		
4	Sealing test - entire system:  Minimum pressure after 10 min.: Minimum pressure after 20 min.:	3,3 bar 3,2 bar	
5	Fuel-injection valve opening pressure:	3,7...4,8 bar	
6	Delivery quantities - comparison measurement: (actuator current 0 mA)  Idle: Part load: Full load:  Minimum quantity at max. sensor-plate deflection	Setting point: (cm <sup>3</sup> /min)	Max. allow. quantity: (cm <sup>3</sup> /min)
		10 6,6 42,5	6,0 40,0 100,0
		109,0 cm <sup>3</sup> /min	



p 1 = Primary pressure  
p 2 = Lower-chamber pressure  
I = Actuator current



## TEST SPECIFICATIONS (CONTINUED)

No.	Test/Test condition	Set values								
7	Flow rate, KE-throttle:	130...150 cm <sup>3</sup> /min								
8	Temperature sensor (engine) NTC Engine cold (+15...+30°C): Engine warm (approx. +80°C):	1.3...3.6 k Ω 250...390 Ω								
9	Thermo-time switch - resistance measurement:  Terminal G and ground: Terminal W and ground: Terminal G and terminal W:	<table><tr><th>Below +10°C</th><th>Above +20°C</th></tr><tr><td>25...40 Ω</td><td>50... 80 Ω</td></tr><tr><td>0 Ω</td><td>100...160 Ω</td></tr><tr><td>25...40 Ω</td><td>50... 80 Ω</td></tr></table>	Below +10°C	Above +20°C	25...40 Ω	50... 80 Ω	0 Ω	100...160 Ω	25...40 Ω	50... 80 Ω
Below +10°C	Above +20°C									
25...40 Ω	50... 80 Ω									
0 Ω	100...160 Ω									
25...40 Ω	50... 80 Ω									
10	Idle-mixture-adjusting screw - basic setting: Fuel distributor support - needle bearing:	21.0...21.6 mm								
11	Air-flow-sensor potentiometer: Voltage signal - sensor-plate basic setting:	0.01...0.05 V								
12	Resistance, start valve	6...14 Ω								
13	Sensor-plate position (off position) beneath basic setting:	see sensor-plate sticker								
14	Sensor-plate idle travel:	0.1...2.0 mm								
15	Idle switch - switching point (measured with feeler gauge at throttle-plate lever):	0.15...0.5 mm								
16	Full-load switch - switching point before full-load stop (angle measurement):	8...12°								

## TEST VALUES (CONTINUED)

No.	Test/Test conditions	Set values
17	Idle adjustment: *)  Regulated idle speed (check value): On/off ratio to be set: (Bypass screw)  Exhaust-gas setting via pressure-regulator current. Test value: Setting: CO content in exhaust gas (check value):	  750...850 min <sup>-1</sup> 27...29 %    4...16 mA 9...11 mA 0.3...1.2 vol. %

## \*) Notes on idle adjustment:

Exhaust-gas regulation is effected automatically by way of lambda closed-loop control.

The pressure-regulator actuation current is tested during closed-loop-control operation (fluctuating current reading).  
If current reading is outside test specification, effect correction to setting by adjusting idle-mixture-adjusting screw.

CO check value is used to check whether there is a leak in the exhaust system between engine and lambda sensor.  
Measurement at exhaust sampling pipe to right of intake manifold.

To perform idle test, switch off all electrical loads and A/C.  
Radiator fan must not be running. Detach crankcase breather at cylinder head and seal.  
Detach hose from tank ventilation valve to air intake scoop from angle piece and leave it open.

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER  
ETT 018.01 WITH KE2 ADAPTER CABLE 1 684 463 135 AND  
SUITABLE MULTIMETER:

The following rapid diagnosis chart makes it possible for the experienced Jetronic specialist to rapidly test the electrical/electronic peripheral and control-unit functions of the KE-Jetronic, including lambda closed-loop control.

Important information concerning the following rapid diagnosis chart:

The "test conditions" column specifies the test steps during which the control-unit plug must be connected or disconnected. Great care must be taken to ensure that the system is without current during all plugging and unplugging operations, i.e. the ignition must be switched off and the electrical safety circuit must not be bridged.

The "test connections" column indicates the leads in the current path for the measurement being made, with reference to the pin assignment of the control-unit plug. Any trouble-shooting that may be required will involve these leads.

For production reasons:  
continued on the following  
coordinate.

# RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01

No.	Switch/but. V	$\Omega$	BU	Testing of	Test con- nections	Test conditions	Set values
1	 V	4	-	Pressure regulator Internal resistance ( $R_1$ )	12 - 10	Detach control-unit plug.	20...30 $\Omega$
2	 V	5	-	Temperature sensor (coolant) Internal resistance	21 - 2	Control-unit plug detached. Engine temperature +15...+30°C: approx. +80°C:	1.3...3.6 k $\Omega$ 250...390 $\Omega$
3	 V	11	-	Ground, control-unit output stage	20 - 2	Control-unit plug detached.	0...10 $\Omega$
4	 V	9	-	Throttle-valve switch Idle	13 - 2	C a u t i o n , voltage measurement! Connection of voltmeter: Negative = black socket "V" Positive = left-hand, blue socket " $\Omega$ " Control-unit plug detached.  Switch on ignition. Throttle valve closed: Throttle valve open:	8...15 V 0 V
5	 V	10	-	Throttle-valve switch Full load	5 - 2	C a u t i o n , voltage measurement! Connection of voltmeter: Negative = black socket "V" Positive = left-hand, blue socket " $\Omega$ " Control-unit plug detached.  Switch on ignition. Throttle valve closed: Throttle valve fully open:	0 V 8...15 V



# RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/ V	but. $\Omega$	BU	Testing of	Test con- nections	Test conditions	Set values
6	4	—	—	Starting signal, term. 50	24 - 2	Control-unit plug detached. Actuate starting motor:	8...15 V
7	5	—	—	TD signal, ignition	25 - 2	Control-unit plug detached. Actuate starting motor for several seconds:	Undefined voltage value
8	6	—	—	Control unit Supply	1 - 2	Control-unit plug detached. Switch on ignition.	8...15 V
9	7	—	—	Supply potentiometer air-flow sensor	18 - 2	Connect control unit. Switch on ignition.	7...8 V
10	8	—	—	Signal potentiometer air-flow sensor	17 - 2	Control unit connected. Switch on ignition. Sensor plate in off position: Deflect sensor plate by hand, continuous voltage increase to max.:	0.01...0.05 V 8 V
11	10	—	—	Idle actuator Supply and continuity Winding 1	3 - 2	Switch off ignition. Detach control-unit plug. Switch on ignition.	8...15 V
12	11	—	—	Idle actuator Continuity, winding 2	4 - 2	Control-unit plug detached. Switch on ignition.	8...15 V
13	12	—	—	A/C signal	19 - 2	Switch off ignition. Connect control unit. Start engine, switch on A/C and adjust such that A/C compressor runs as well. Voltage reading:	8...15 V

# RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

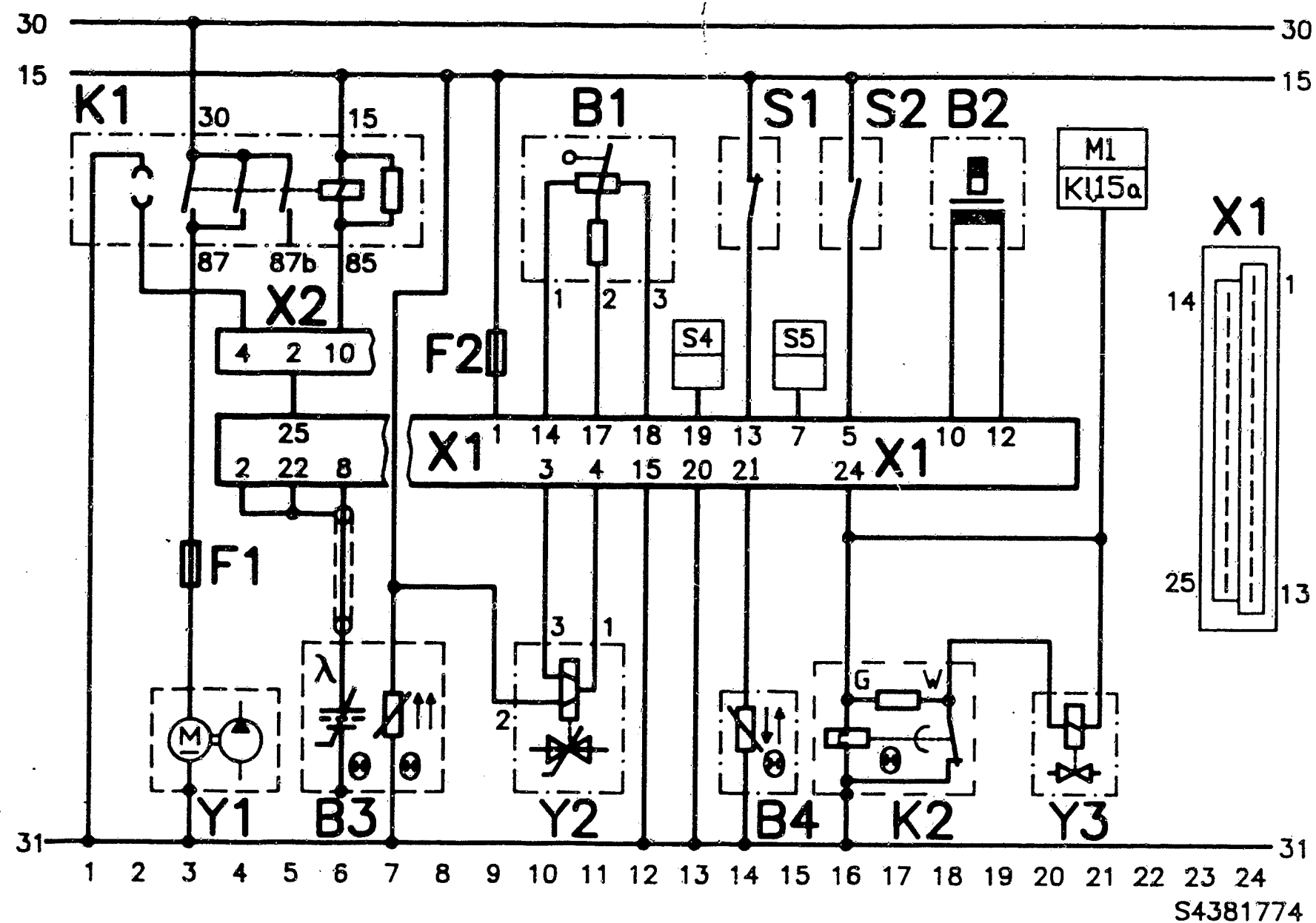
No.	Switch/ V	but. $\Omega$	BU	Testing of	Test con- nections	Test conditions	Set values
14	14	24	-	Lambda closed-loop control Control function	23 - 2	Control unit connected. Jumper sockets 1 and 2 at test adapter. Engine at operating temperature, idling. Control function: fluctuating voltage reading. Mean value:	approx. 3 V
15	-	21	1	Warm-up enrichment -20°C	12 - 12	Current measurement! Measuring instrument connection: Negative = black socket 1 Positive = black socket 2 Control unit connected. Switch on ignition.	60... 80 mA
16	-	21	2	Actuator current Engine at operating temperature	12 - 12	Control unit connected. Switch on ignition.	9... 11 mA
17	-	21	1 /4	Post-start enrichment	12 - 12	Control unit connected. Switch on ignition. Keep button 1 pressed: Briefly press button 4 and release. Current increased to: Slow breakaway to after brief dwell time:	60... 80 mA 130...150 mA 60... 80 mA
18	-	21	1 /6	Acceleration enrichment	12 - 12	Control unit connected. Switch on ignition. Keep buttons 1 and 6 pressed. Current value: Rapidly deflect sensor plate. Current increase to: Breakaway approx. 1 second to:	60... 80 mA 110...150 mA 60... 80 mA

# RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/ V	but. $\Omega$	BU	Testing of	Test con- nections	Test conditions	Set values
19	—	21	2	Overrun cutoff	12 — 12	Control unit connected. Reconnect ammeter (reverse positive and negative). Start engine. Maintain engine speed n at approx.:  Actuate throttle-valve switch (idle) whilst button 2 pressed. Current reading during decreasing engine-speed phase: Reconnect ammeter again.	2000 min <sup>-1</sup>   -30...-60 mA
20	—	21	—	Full-load enrichment	12 — 12	Control unit connected. Start engine and maintain engine speed n at approx.: Actuate throttle-valve switch (full load). Current increase by:	2500 min <sup>-1</sup>  6...10 mA
21	—	24	—	Lambda closed-loop control Control function	12 — 12	Control unit connected. Engine at operating temperature, idling. Closed-loop control operation can be seen from fluctuating current reading. Mean value:  If mean value outside tolerance, adjust (idle-mixture-adjusting screw) to:	4...16 mA  9...11 mA
22	—	22	—	Lambda closed-loop control Rich stop	12 — 12	Control unit connected. Switch on ignition. Current increase to:	18...20 mA
23	—	23	—	Lambda closed-loop control Lean stop	12 — 12	Control unit connected. Switch on ignition. Drop in current to:	0... 2 mA

# RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

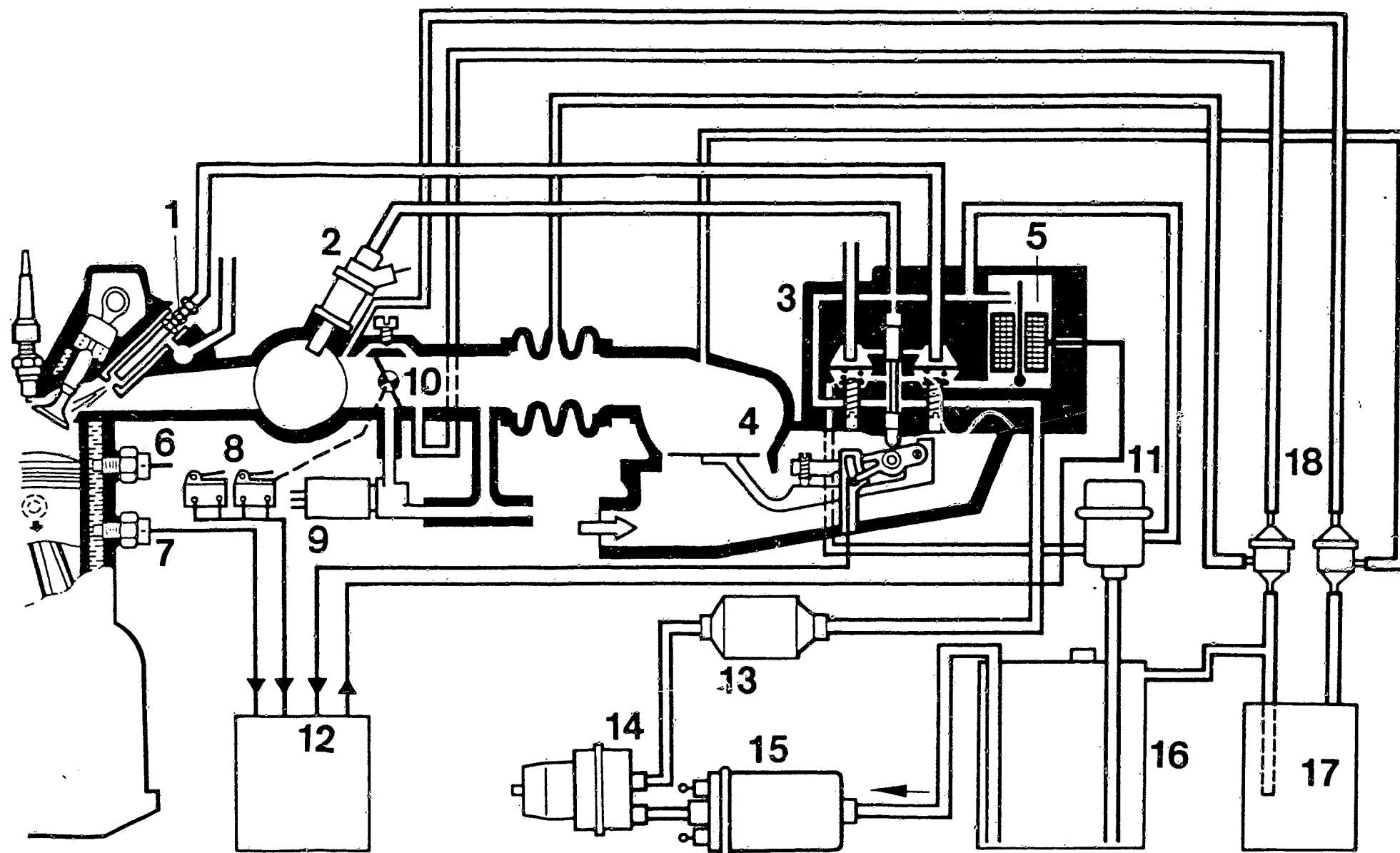
No.	Switch/ V	but. $\Omega$	BU	Testing of	Test con- nections	Test conditions	Set values
24	10	—	—	Idle-speed regulation		<p>Control unit connected. Test with lambda closed-loop-control tester. Jumper black sockets 1 and 2 at test adapter.</p> <p>Engine at operating temperature, idling. Idle speed (regulated): On/off ratio at idle speed: Adjust on/off ratio if necessary (bypass screw at throttle-valve assembly).</p> <p>Switch on A/C (compressor). Engine speed:</p>	<p>750...850 min<sup>-1</sup> 27... 29 %</p> <p>750...850 min<sup>-1</sup></p>



# ELECTRICAL TERMINAL DIAGRAM

B1 = Air-flow-sensor potentiometer  
 B2 = Pressure regulator  
 B3 = Lambda sensor (heated)  
 B4 = Temperature sensor (engine)  
 F1 = Fuse 13 (15 A)  
 F2 = Fuse 28 (15 A)  
 K1 = Electric-fuel-pump relay  
 K2 = Thermo-time switch  
 M1 = Starting motor, terminal 15a  
 S1 = Throttle-valve switch, idle  
 S2 = Throttle-valve switch, full load

S4 = Signal input, A/C  
 S5 = Connection, transmission switch  
 (automatic transmission only;  
 pin 7 is grounded with manual  
 transmission)  
 X1 = Plug, KE control unit  
 X2 = Plug, ignition control unit  
 Y1 = Electric fuel pump  
 Y2 = Idle actuator  
 Y3 = Start valve



438/1775

DIAGRAM OF AIR AND FUEL LINES

- 1 = Injection valve
- 2 = Start valve
- 3 = Fuel distributor
- 4 = Air-flow sensor
- 5 = Pressure regulator
- 6 = Thermo-time switch
- 7 = Temperature sensor (engine)
- 8 = Throttle-valve switch  
(idle, full load)

- 9 = Idle actuator
- 10 = Throttle valve
- 11 = System pressure regulator
- 12 = Control unit, KE-Jetronic
- 13 = Fuel filter
- 14 = Fuel accumulator
- 15 = Electric fuel pump

- 16 = Fuel tank
- 17 = Active-carbon container
- 18 = Tank-ventilation switching valves

# INSTALLATION POSITION OF COMPONENTS, REMOVAL AND INSTALLATION INSTRUCTIONS

- \* Components in engine area: see basic microcard AUD 507.
- \* Fuel supply components:  
Electric fuel pump, fuel accumulator, fuel filter and pre-filter are located on a joint bracket on the underside of the vehicle in the area in front of the rear axle.
- \* KE-Jetronic control unit: between front right bulkhead and air duct.  
To remove, take out trim in front of glove compartment. Press locking mechanism towards bulkhead and pull out control unit downwards.
- \* Catalytic converter with lambda sensor (at catalytic-converter inlet): on underside of vehicle in area behind front axle.

New seals and hose clips are always to be used if fuel connections are detached and parts removed (including on vacuum system).

Pay attention to maximum cleanliness when working on KE-Jetronic. The outside of fuel connections is always to be thoroughly cleaned prior to detaching them.

Special assembly paste VS 14 016 Ft (5 964 080 105) is always to be applied to the thread before fitting a new lambda sensor. Make sure that only the threads are coated and that no paste gets into the slits in the protective sleeve.

For production reasons:  
continued on the following  
coordinate.

Trouble-shooting instructions : BMW-5026  
BOSCH system : ABS  
Make of vehicle : BMW  
Basic microcard : PKW-040

## TABLE OF CONTENTS

Section	Coordinates
Special features .....	02
Structure, usage .....	02
Safety and precautionary measures .....	02
Test requirements .....	03
Rapid diagnosis chart .....	05
Test specifications .....	17
Electrical terminal diagram .....	19
Installation position of components, notes on removal and installation .....	21

## SPECIAL FEATURES

This microcard, valid at the time of publication, contains trouble-shooting instructions for the following models:

BMW 318i, 320i, 325i, 325e, 324td  
09.1987->

- \* ABS with 4 wheel-speed sensors and 3 hydraulic channels.
- \* Sensor ring gear with 48 teeth.
- \* As of 9.88 the ABS voltage supply for vehicles with petrol engines is tapped from the Motronic relay term. 87.

## STRUCTURE, USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

For a detailed description of trouble-shooting, see the basic instructions.

## ATTENTION :

The set values, terminal assignments and special features of these vehicle-specific brief instructions are always binding.

## SAFETY AND PRECAUTIONARY MEASURES

- \* For safety reasons, the hydraulic modulator must not be repaired, but be exchanged as a complete unit.  
Exception: relays.
- \* Do not loosen any screws on the hydraulic modulator!  
Danger of fatal accident due to brake failure.
- \* Caution when handling brake fluid.  
Poisonous!

For further information, see basic instructions.



## TEST REQUIREMENTS FOR TESTING WITH ABS2 LED TESTER

- \* Regulatory tire size fitted?
- \* Check for firm seating of ground of return-supply pump.
- \* Check for firm seating and corrosion of ground of overvoltage-protection relay term. 31.
- \* Check for firm seating of ground strap between engine block and vehicle frame.
- \* Check for leaks in hydraulic connections at hydraulic modulator and sealing points (visual examination).
- \* If the ABS warning lamp lights up intermittently when driving (e.g. after switching on loads) and goes out again by itself, check the battery and power supply (alternator, regulator and voltage drops).
- \* If the ABS warning lamp lights up constantly and does not go out, check the following points:
  - Controller plug sitting correctly on controller and latched?
  - All plug contacts O.K.?
  - Spring contacts latched?
  - Check installation position for correct seating of seal ring in controller plug, rounded side downward.

- Check wheel-speed-sensor leads for correct assignment at controller plug:

### Wheel-speed sensors:

front left to term. 6 and term. 4.  
front right to term. 11 and term. 21.  
rear left to term. 8 and term. 9.  
rear right to term. 24 and term. 26.  
rear axle to term. - and term. -.

- V-belt snapped?  
(Alternator provides no voltage, charge-indicator lamp and ABS warning lamp light up).
- \* Connect ABS 2 LED tester to ABS wiring harness.
- Disconnect and connect controller only with ignition switched off.
- For testing, switch on ignition in all program-selector-switch positions (tester operates with current supply from vehicle battery).
- Observe LED (green) for current supply in all program-selector-switch positions.

## C A U T I O N !

Do not drive with tester connected!  
The brake system must be bled of air before the ABS test. Do not activate the ABS tester while the system is being bled.  
Repeat the complete test program after any repairs are carried out.  
The Antiskid System is a vehicle safety system.  
Work on the system demands detailed knowledge of the system.  
The conventional brake system must be O.K.

### General information for trouble-shooting:

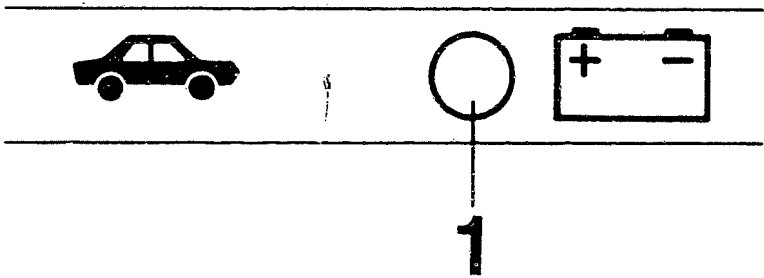
Check all leads for short circuit to ground and contact with positive leads and watch out for worn cable insulation and pinched leads.

RAPID DIAGNOSIS CHART

Never drive with tester connected ! Have all test prerequisites been satisfied?

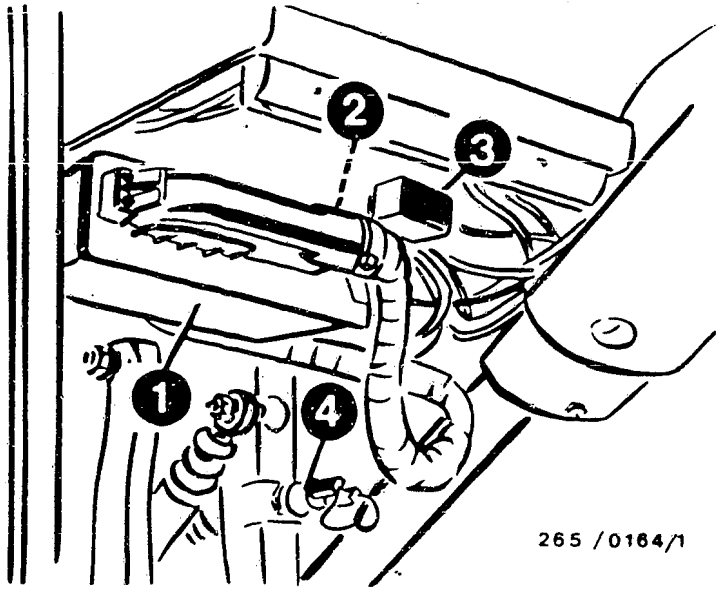
Program-selector switch setting 1 - 6

Test of (measurement at terminals)	Additional operation	Test specification (indication)	Possible causes of trouble
Voltage supply  (Term. 1 and term. 20)	Ignition on	LED 1 (top picture) lights up continuously	<ul style="list-style-type: none"><li>* Battery insufficiently charged.</li><li>* Voltage dips too high.</li><li>* Test leads from relay plug to controller at term. 1, to driving switch term. 15 and to ground terminal.</li><li>* Over-voltage protection relay or Motronic relay defective.</li></ul>



265 / 242

- 1 = ABS controller
- 2 = Ground terminal
- 3 = Over-voltage protection relay
- 4 = Stop-lamp switch

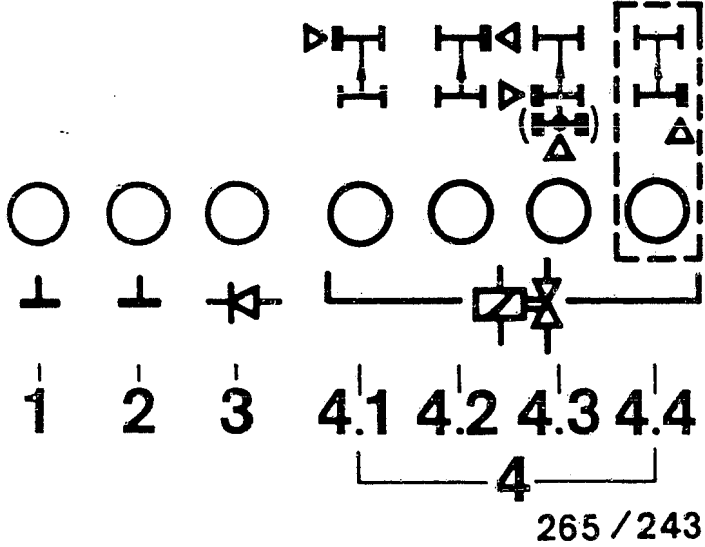


265 / 0164/1

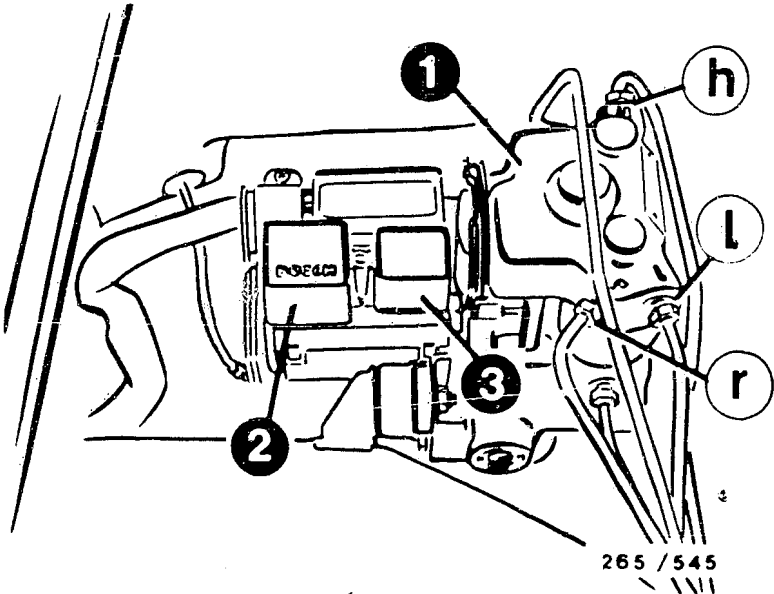
RAPID DIAGNOSIS CHART (CONTINUED)

Program-switch position 1 (3-channel hydraulic modulator)

Testing of (measurement at terminals)	Addition- al operation	Test specifi- cation (reading)	Possible causes of faults
Ground connection (term.10, term.34)  Diode for warning lamp (term.29, term.32) Solenoid-operated valve internal res. (term.2, term.18, term.35, term.-)  Off-position and ground connection of relay  ABS warning lamp	Ignition on	6 LED (1 to 4.3)  simultaneously brightly lit (top picture)  ABS warning lamp in vehicle must light up	<ul style="list-style-type: none"><li>* LED 1 and/or 2 (top picture) not lit:  Check ground terminals for open circuit.</li><li>* LED 3 (top picture) not lit: Diode defective, check ground connection of valve relay.</li><li>* One or more LEDs 4 not lit: Check corresponding plug-in connection for solenoid- operated valve and leads.</li><li>Solenoid-operated valve internal resistance 0,7...1,7 <math>\Omega</math></li><li>* All LEDs 4 and LEDs 3 not lit: Check ground connection of valve relay, valve relay defective.</li><li>* Dimmer lighting-up of an LED means contact resistance in the corresponding circuit.</li><li>* ABS warning lamp not lit: Warning lamp defective. Note: all other 5 LEDs lit.</li></ul>



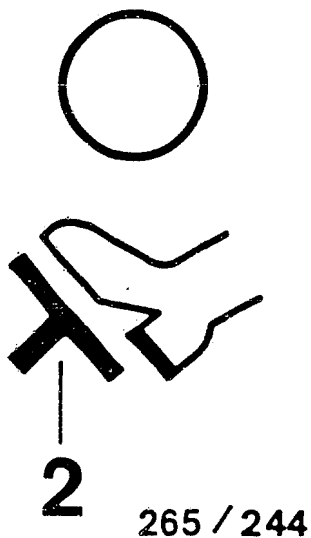
- 1 = Hydraulic modulator
- 2 = Motor relay
- 3 = Valve relay



RAPID DIAGNOSIS CHART (CONTINUED)

Program-selector-switch position 2

Under test (Measurement at the terminals)	Additional operation	Test specifi- cation (reading)	Possible causes of trouble
Alternator voltage from term. 61/D+ (term. 15)	Ignition on	LED 1 (top picture) lit.	* In some cases, LED does not go out until after burst of throttle (test is O.K. in this case).
	Start engine	LED 1 (top picture) goes out when engine running	* Test lead and signal from alternator term. 61/D+  * Alternator defective.
Stop-lamp switch (term.25)	Ignition on	LED 2 (top picture) lit	* Stop-lamp switch defective.  * Check lead to stop-lamp switch.
	Press brake pedal	LED 2 (top picture) goes out	* Lead incorrectly connected to to stop-lamp switch.

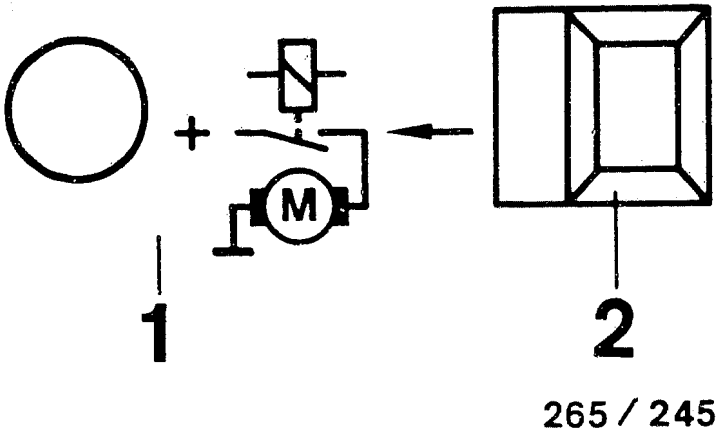


265 / 244

RAPID DIAGNOSIS CHART (CONTINUED)

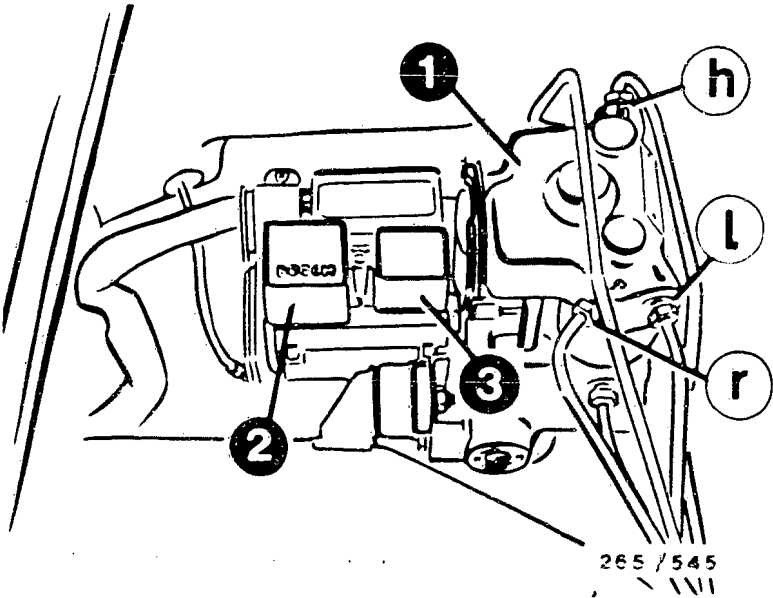
Program-selector-switch position 3

Under test (measurement at the terminals)	Additional operation	Test specification (reading)	Possible causes of trouble
Motor relay, pump motor in hydraulic modulator (term.14 and term.28)	Ignition on, press button 2 contin- uously (top picture)	LED 1 lights up, pump motor runs.  After releasing button, LED con- tinues to light due to run-on of motor (top picture)	<ul style="list-style-type: none"><li>* Motor relay defective</li><li>* Test ground connection and positive terminal of pump motor</li><li>* Test following leads:  From controller term. 14 and term. 28 to hydraulic modulator term. 9 or term. 11. Positive leads to hydraulic modulator term. 10 and term. 12.</li><li>* Pump motor or hydraulic modulator defective.</li></ul>



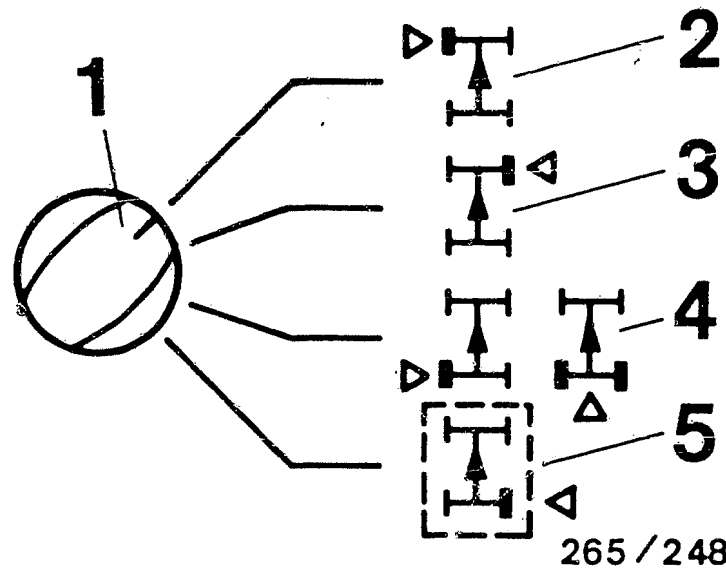
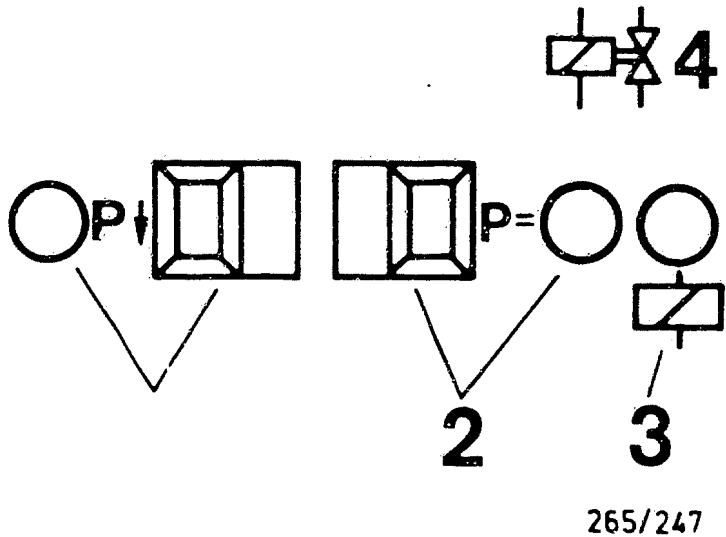
Program-selector-switch position 4 does not apply.

- 1 = Hydraulic modulator
- 2 = Motor relay
- 3 = Valve relay



RAPID DIAGNOSIS CHART (CONTINUED)  
Program-selector-switch position 5 (3-channel hydraulic modulator)

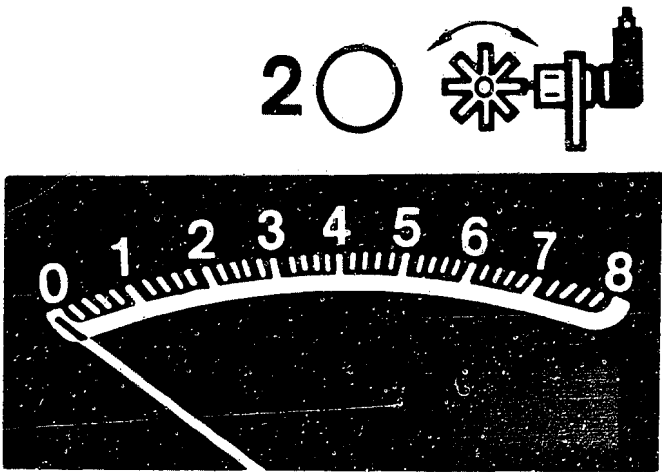
Under test (measurement at the terminals)	Additional operation	Test specification (reading)	Possible causes of trouble
Valve relay operation (term. 27)	Ignition on	LED 3 (upper illustration) lights up	* Valve relay (winding) or leads defective
Solenoid-operated valves in hydraulic modulator for operation and and mix-up. NOTE: Check each wheel separately in turn. Keep to operating sequence.	Chock up vehicle. Ignition on. The wheel being tested must be freely turnable by hand. Set switch 1 for wheel selection to wheel to be tested (center illustration).		* Repeat test with engine running  * Valve relay (make contact) defective  * Break in lead from valve relay term. 87 to B+  * Brake leads at hydraulic modulator mixed up
Operation, pressure holding	1. Constantly press push-but. P = (upper illustration)	LED P= (upper illustration lights up)	* Current value not obtained (LED P arrow or P= goes out; upper illustration); battery insufficiently charged. Repeat check with engine running.
	2. Constantly press brake pedal	Wheel turnable by hand	
	3. Release push-button P = (upper illustration)	LED P= goes out (upper illustration) Wheel locks	
Operation, pressure reduction	4. Press push-button P arrow (upper illustration)	LED P arrow (upper illustration) lights up, wheel turnable by hand	* Solenoid-operated valves correctly connected electrically? Wheel, front left: term. 2 Wheel, front right: term. 35 Wheel, rear left: term. - Wheel, rear right: term. - Rear axle: term. 18  * Hydraulic modulator defective
	5. Release push-button P arrow (upper illustration)	LED P arrow (upper illustration) goes out, wheel locks	
	6. Release brake pedal		



RAPID DIAGNOSIS CHART (CONTINUED)

Program-selector-switch position 6 (4 wheel-speed sensors)

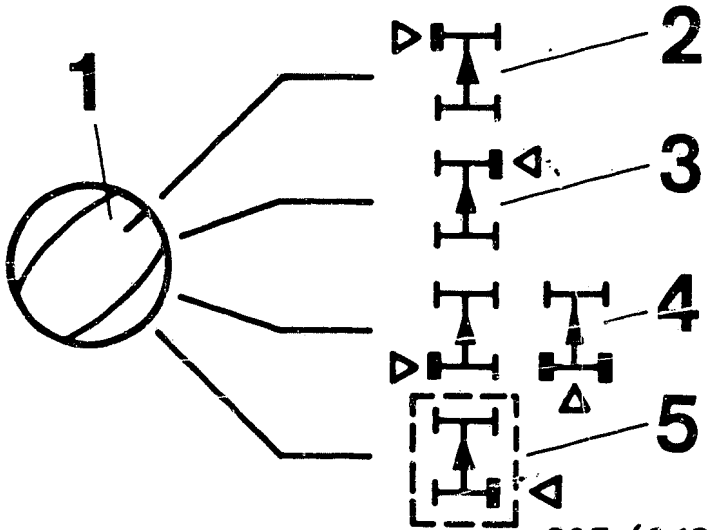
Under test (measurement at the terminals)	Additional operation	Test specification (reading)	Possible causes of trouble
<p>Wheel-speed sensor for operation and mix-up</p> <p>NOTE: Check each wheel separately in turn.</p> <p>Wheel, front left: term.4 and term.6</p> <p>Wheel, front right: term.11 and term.21</p> <p>Wheel, rear left: term.8 and term.9</p> <p>Wheel, rear right: term.24 and term.26</p>	<p>Chock-up vehicle. Ignition on.</p> <p>The wheel being tested must be freely turn- able by hand.</p> <p>When testing the driven axle, the wheel not being tested must be locked.</p> <p>Set switch for wheel selection to wheel to be tested (lower illustration)</p> <p>Turn wheel by hand until LED 2 above instrument lights up without flickering. (Wheel speed approx. 1 revolution per second). Afterwards, read off indication at instrument: (upper illustration)</p>	<p>1. Smallest reading larger 1,6 divisions</p> <p>2. Permissible fluctuation max. 25 % of largest reading.</p>	<p>*Wheel-speed-sensor lead mixed up</p> <p>*Brake in wheel-speed- sensor lead</p> <p>*Wheel-speed sensor defective</p> <p>Winding resistance Front axle: 0,6...1,6 k <math>\Omega</math></p> <p>Rear axle: 0,6...1,6 k <math>\Omega</math></p> <p>*Air gap between wheel- speed sensor and ring gear too wide</p> <p>*Ring gear defective (e.g. corroded, dirty) or loose.</p> <p>*Ring gear with incorrect number of teeth installed Front axle: 48 teeth Rear axle: 48 teeth</p> <p>*Wheel-bearing clearance too large</p> <p>*Instrument gives reading, LED 2 does not light up: loose contact in wheel- speed sensor lead.</p>



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265 / 249



265 / 248

# TEST SPECIFICATIONS

## Wheel-speed sensor

* Winding resistance at ambient temperature (-10°C...+120°C) for front wheels:	600...1600 $\Omega$
rear wheels:	600...1600 $\Omega$

## Hydraulic-modulator solenoid valves

* Winding resistance at ambient temperature (-10°C...+120°C):	0,7...1,7 $\Omega$
---	--------------------

## Air gap between wheel-speed sensor and ring gear

* at front wheels:	0,8 $\pm$ 0,5 mm
* at rear wheels:	0,8 $\pm$ 0,5 mm

## Tightening torque for

* fastening screws of wheel-speed sensors:	> 8 Nm
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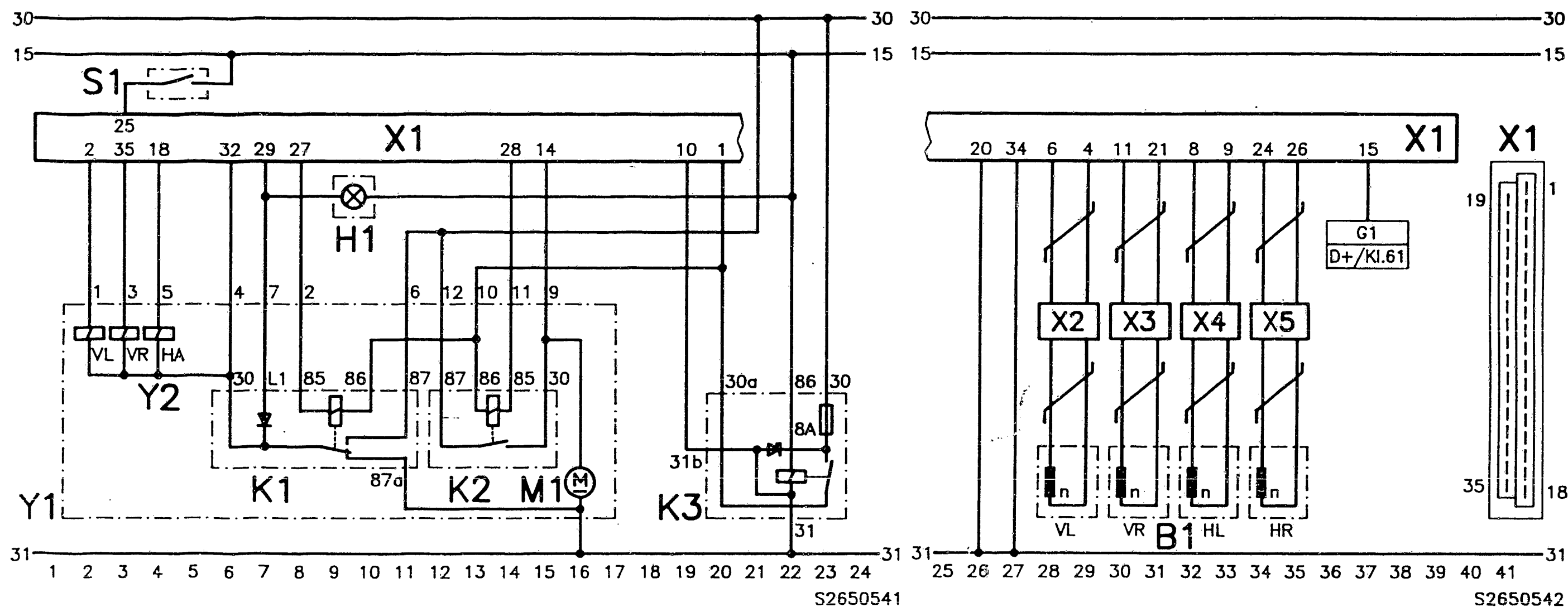
* Brake-line connections at hydraulic modulator:	12...16 Nm
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## Number of teeth on ring gears of wheel-speed sensors

* at front wheels:	48 teeth
* at rear wheels:	48 teeth

For production reasons:  
continued on the following  
coordinate.



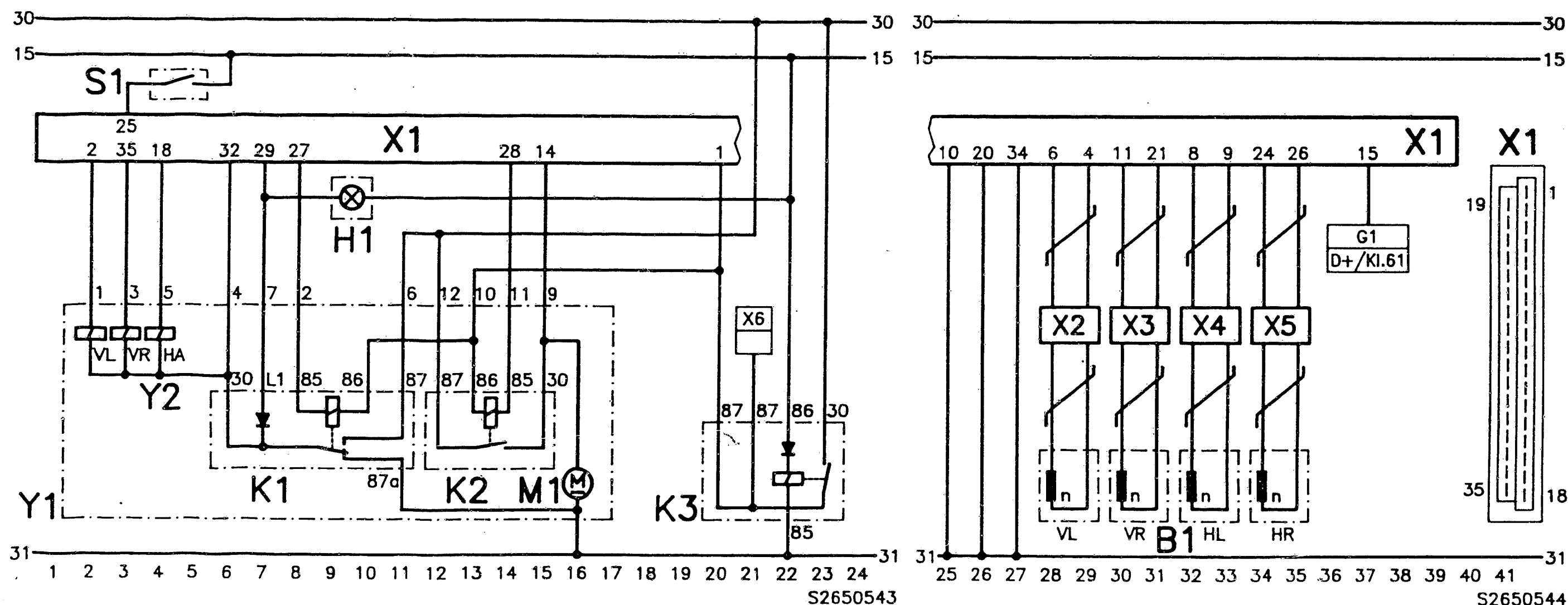


ELECTRICAL TERMINAL DIAGRAM  
for BMW 318i, 320i, 325i and 325e up to 8.88 and 324td

B1 = Wheel-speed sensor  
G1 = to alternator  
H1 = ABS warning lamp  
K1 = Valve relay  
K2 = Motor relay  
K3 = Over-voltage protection relay

M1 = Return-pump motor  
S1 = Stop-lamp switch  
X1 = Controller plug (35-pole)  
X2...X5 = Wheel-speed-sensor plugs  
Y1 = Hydraulic modulator  
Y2 = Solenoid valves

HL = Rear left  
HR = Rear right  
VL = Front left  
VR = Front right

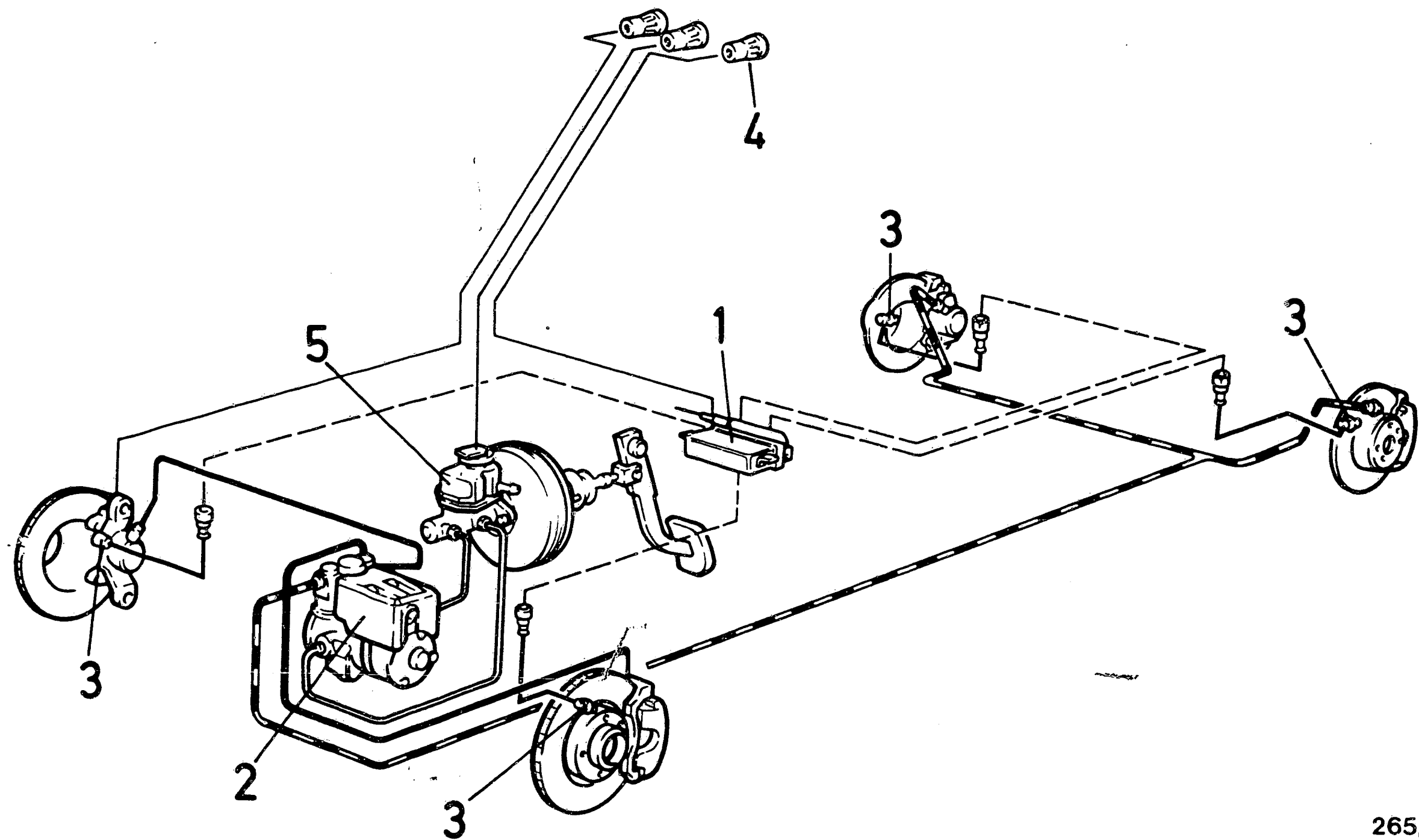


ELECTRICAL TERMINAL DIAGRAM  
for BMW 318i, 320i, 325i and 325e as of 9.88

B1 = Wheel-speed sensor  
G1 = to alternator  
H1 = ABS warning lamp  
K1 = Valve relay  
K2 = Motor relay  
K3 = Motronic relay

M1 = Return-pump motor  
S1 = Stop-lamp switch  
X1 = Controller plug (35-pole)  
X2...X5 = Wheel-speed-sensor plugs  
X6 = Voltage supply for Motronic  
Y1 = Hydraulic modulator

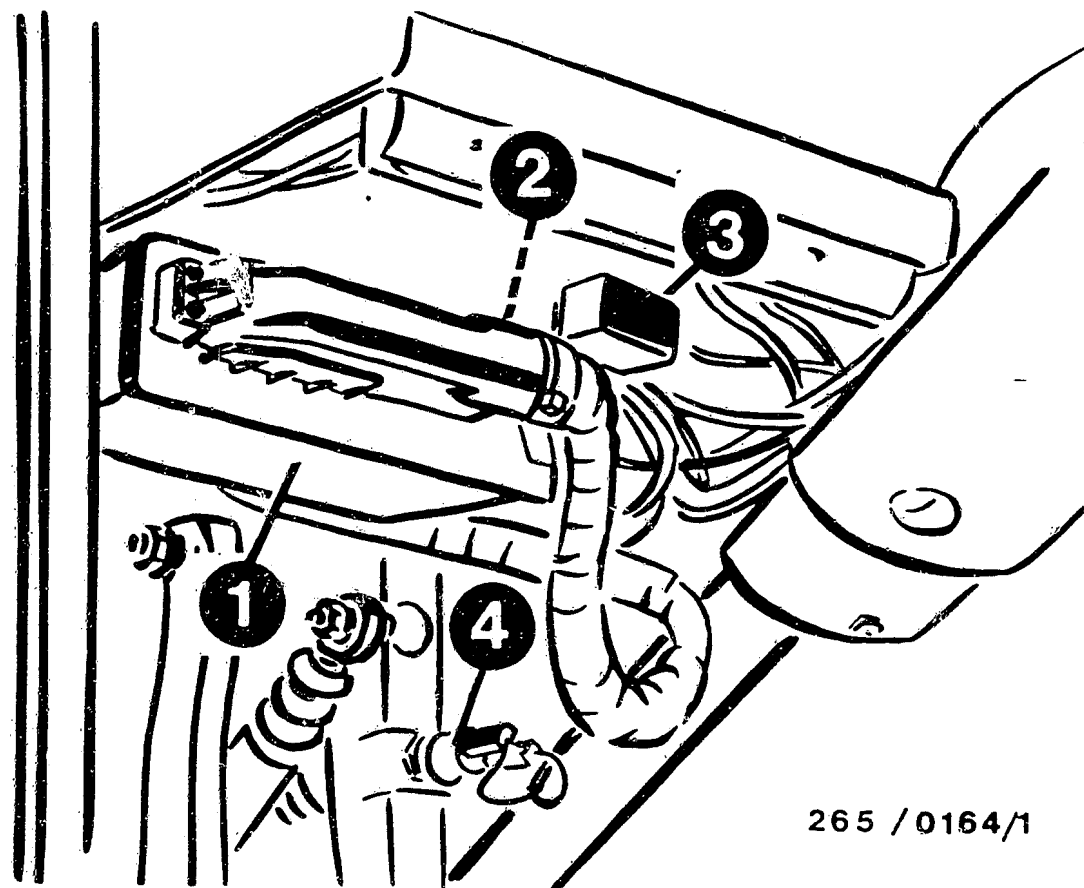
Y2 = Solenoid valves  
HL = Rear left  
HR = Rear right  
VL = Front left  
VR = Front right



265/546

# INSTALLATION POSITION OF COMPONENTS

- 1 = ABS controller
- 2 = Hydraulic modulator
- 3 = Wheel-speed sensor
- 4 = ABS warning lamp
- 5 = Brake fluid reservoir



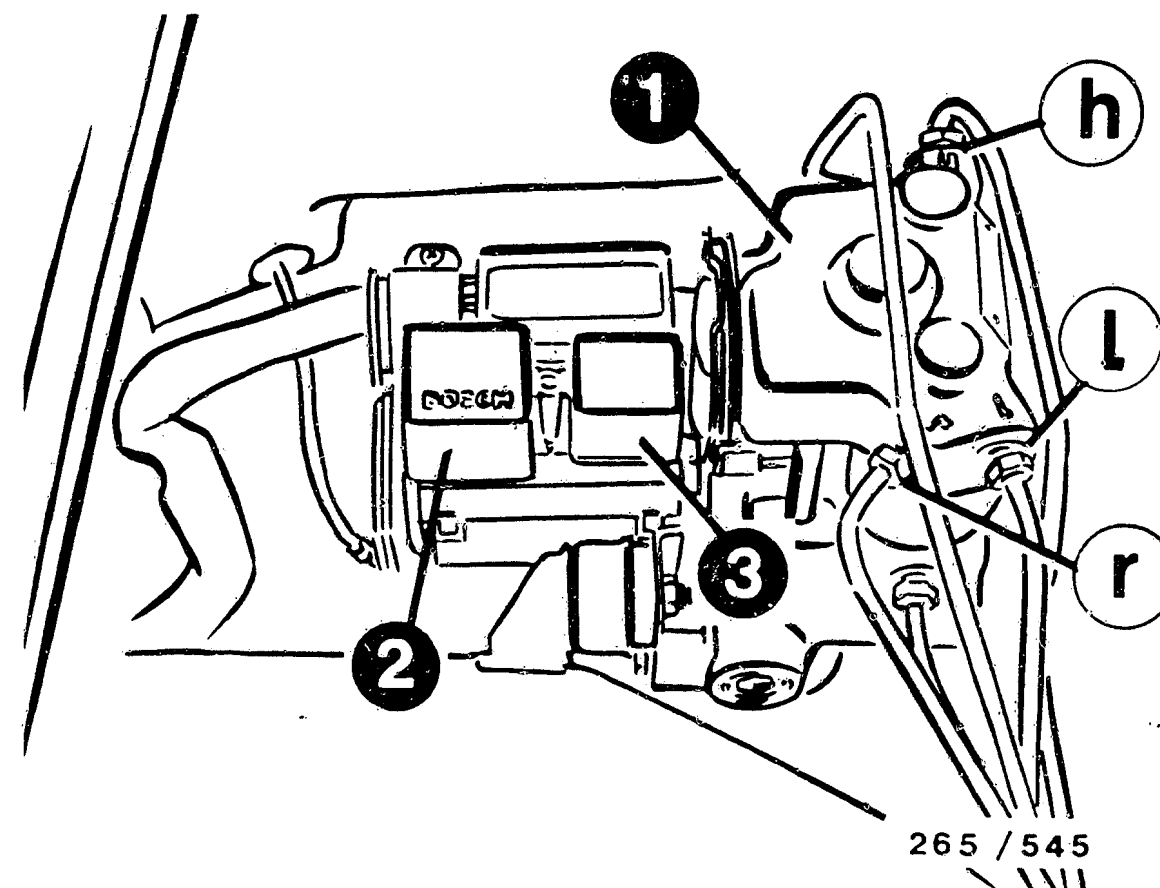
265 / 0164/1

- 1 = ABS controller
- 2 = Ground terminal
- 3 = Over-voltage protection relay
- 4 = Stop-lamp switch

#### INSTALLATION POSITION OF COMPONENTS (continued)

The installation locations always refer to the direction of travel.

- \* Controller:  
To the left of the steering column. Remove bottom left trim.
- \* Over-voltage protection relay:  
On right above controller, clipped into sheet-metal bracket.  
As of 9.88 the voltage supply for the ABS is tapped from the Motronic relay term. 87 (except diesel vehicles)  
318i: Motronic relay in engine compartment at bulkhead, relay color white.  
320i, 325i, 325e: Motronic relay (white) in engine compartment on left in front of spring-strut dome.

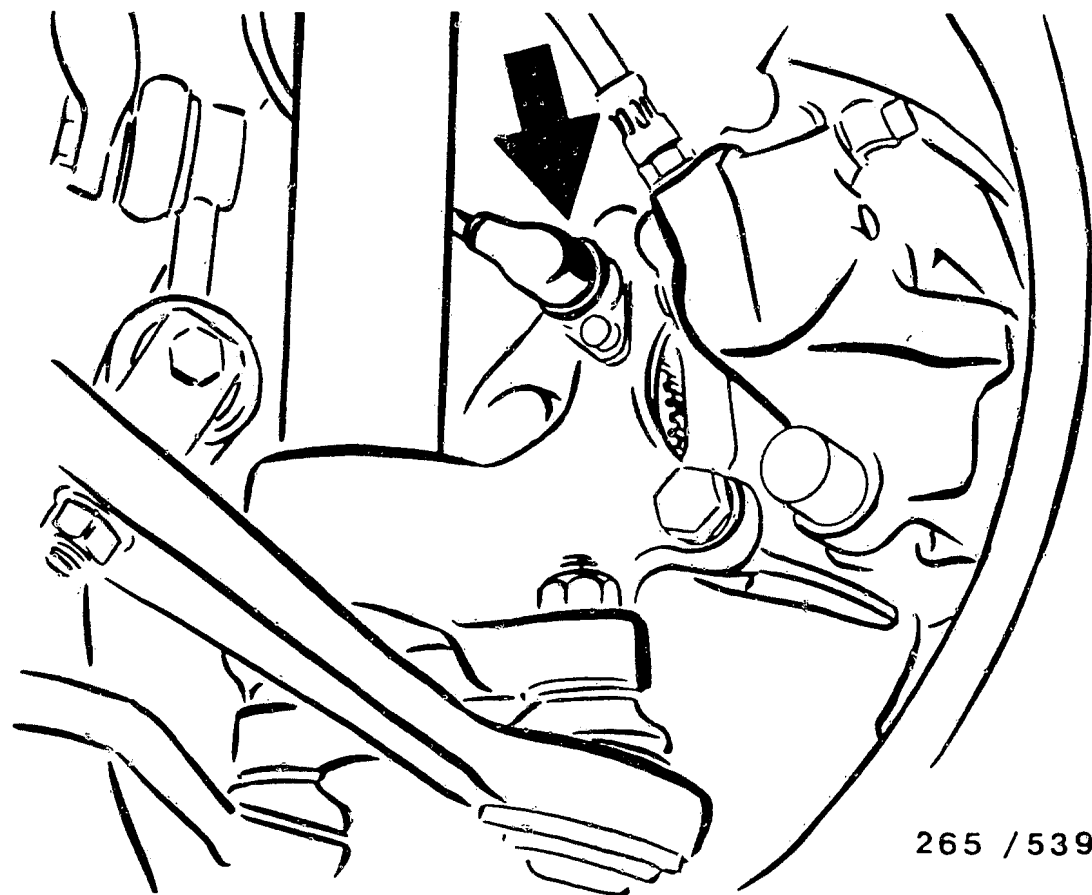


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- 1 = Hydraulic modulator
- 2 = Motor relay
- 3 = Valve relay

#### INSTALLATION POSITION OF COMPONENTS (continued)

- \* Hydraulic modulator:  
In engine compartment behind left-hand headlight.  
  
The hydraulic modulator is not to be repaired, but rather only replaced as a complete assembly.  
Exception: Change of relay.  
  
Pay attention to correct assignment of brake-line connections.
- \* Stop-lamp switch:  
Beneath brake-pedal lever.



Arrow = Wheel-speed sensor, front right

#### INSTALLATION POSITION OF COMPONENTS (continued)

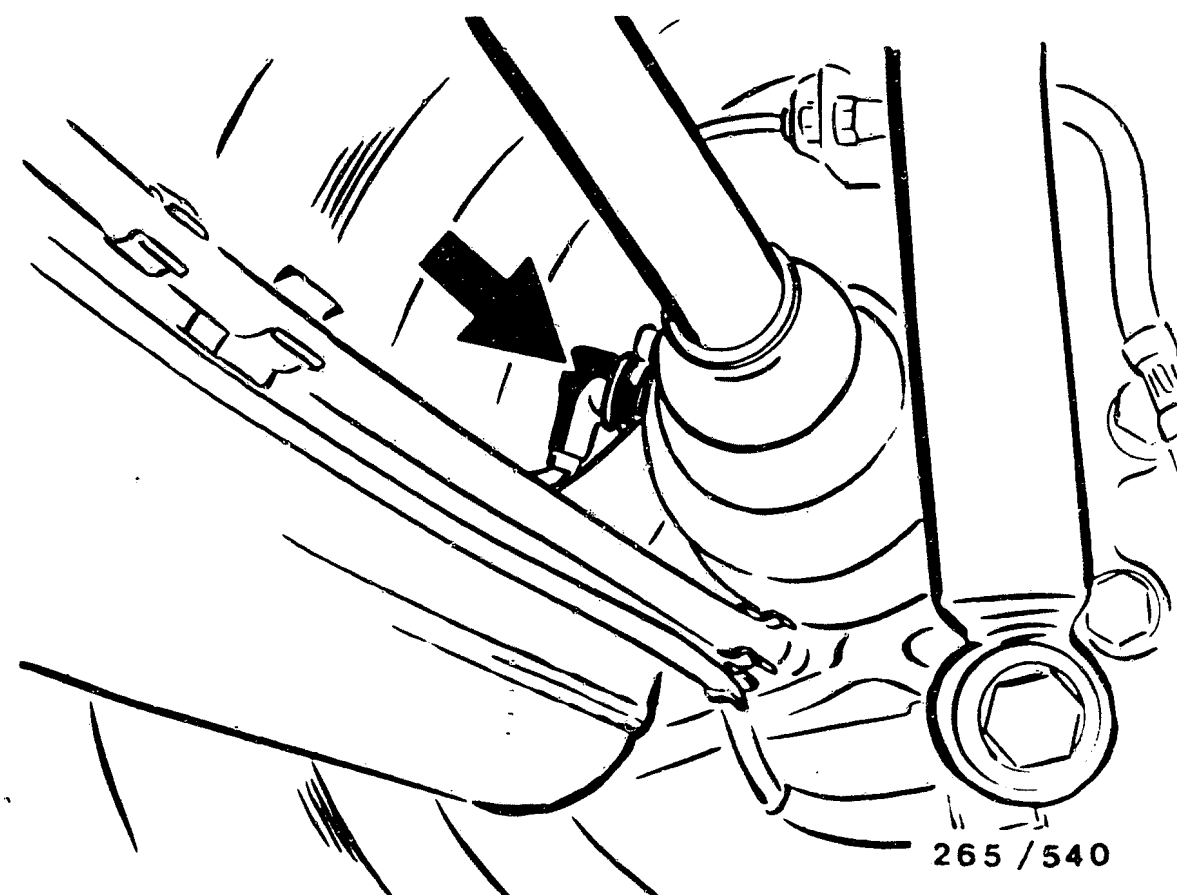
- \* Front-axle wheel-speed sensor:  
One each on left and right in steering knuckles.

##### Note:

Take care not to mix up wheel-speed sensors between left and right, as otherwise the air gap becomes too large and the signal too small.

##### Wheel-speed-sensor plug connections:

In engine compartment on left and right in front of spring-strut domes.



Arrow = Wheel-speed sensor, rear right

#### INSTALLATION POSITION OF COMPONENTS (continued)

- \* Rear-axle wheel-speed sensor:  
One each on left and right at wheels ahead of drive shaft.

##### Wheel-speed-sensor plug connections:

On left and right beneath rear seat bench.

- \* ABS warning lamp:  
In instrument panel.
- \* ABS ground terminal:  
On left next to steering column. Remove lower left trim.

Trouble-shooting instructions : OPE-5018  
BOSCH system : EI  
Make of vehicle : OPEL  
Basic microcard : PKW- 121

## TABLE OF CONTENTS

Section	Coordinate
Special features, usage, safety.....	02
Trouble-shooting chart.....	05
Rapid diagnosis chart.....	07
Test specifications.....	19
Electrical terminal diagram.....	21
Installation position of components, removal and installation instructions.....	23

## SPECIAL FEATURES

These brief instructions, valid at the time of publication, apply to the following Opel model:

Omega 3000 with 3.0 l/ 6-cyl. engine 30 NE  
3.87 ->.

- \* Spark-advance unit 0 227 921 034
- \* Trigger box 0 227 100 124  
(with current limitation)
- \* Ignition coil 1 227 020 009
- \* Ignition coil with trigger box 0 221 600 005
- \* The following changes have been made with regard to the basic instructions:
  1. No spark-advance unit term.5 and term. 8 (for transmission control) and term. 5/term. 15 (for LE-Jetronic) and term. 11 (for idle-speed regulator).
  2. Throttle-valve switch (6-pole) replaced by 3-pole switch. KDZS 0003 must be used for basic ignition setting.
  3. Characteristic-curve control by way of an additional part-load switch (spark-advance unit term. 7).

## STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.  
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

CAUTION!  
High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

For production reasons:  
continued on the following  
coordinate.

## TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Idle problems (engine speed, exhaust gas).
4. Poor throttle take-up, flat spot during acceleration.
5. Engine missing (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

Cause (component fault)										
*			*							High-tension side
*										Firing sequence
*			*							Ignition coil
*										Ignition-distributor as-installed setting
*										Voltage, trigger box
*										Voltage, primary circuit
*										Ignition-distributor plug and socket
*										Voltage, magnetic pulse generator
*										Magnetic-pulse-generator function
*										Spark-advance-unit function
*										Contact resistance (primary side)
*										Primary signal
*	*	*		*	*		*	*		Basic ignition setting
				*	*					Control lead, characteristic curve control
				*	*					Temperature switch (oil)
				*	*					Temp. switch (intake manifold)
				*	*					Part-load switch

## TROUBLE-SHOOTING CHART (CONTINUED)

Customer complaint (fault symptoms)

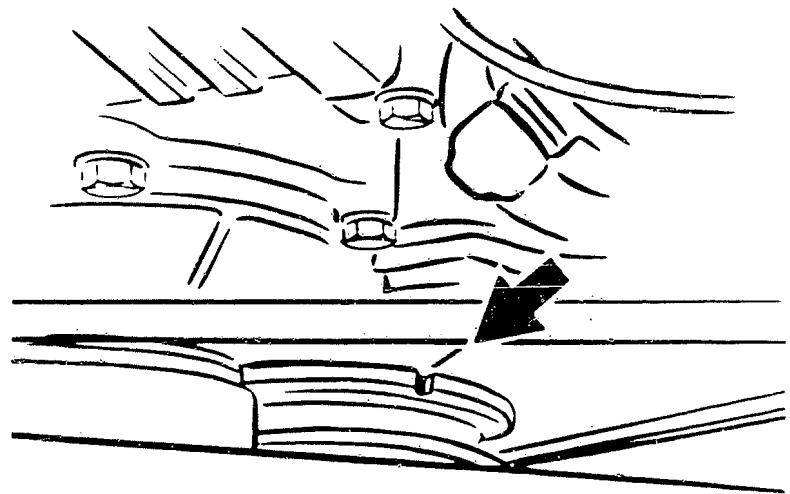
1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Idle problems (engine speed, exhaust gas).
4. Poor throttle take-up, flat spot during acceleration.
5. Engine missing (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

Cause (component fault)										
	*	*		*	*					Throttle-valve switch
										Idle/full load
			*							Voltage, trigger box (engine idling)
			*							Voltage, ignition coil (engine idling)
			*							Primary voltage (engine idling)

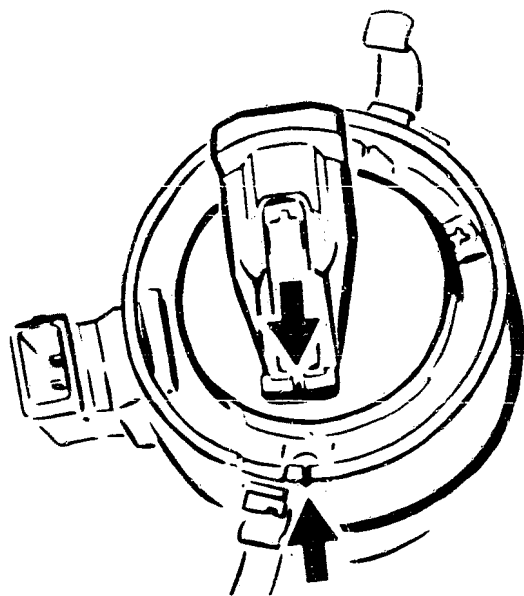


RAPID DIAGNOSIS CHART

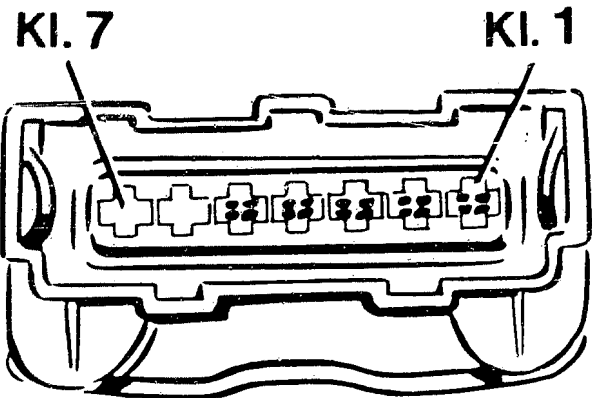
Test step	Testing of component/function Test instructions/conditions	Termin- als	Set values
1	HIGH-TENSION SIDE Test functioning of for example spark plugs, ignition harness and distributor cap (e.g. open-circuit, shunt). Assess for example by way of ignition oscillo- gram, resistance measurement, visual inspection.	—	—
2	IGNITION COIL Visual inspection: Plug present, sealing compound oozed out? Primary resistance Secondary resistance	<div>1 15</div> <div>1 4</div>	<div>0.6...1.0 Ω</div> <div>6.4...11.1 k Ω</div>
3	IGNITION-DISTRIBUTOR INSTALLATION SETTING Engine cyl. no. 1 on pulley mark (10° BTDC). See top picture, arrow. Center of distributor-rotor electrode points towards mark on housing. See center picture, arrow.	—	—
4	TRIGGER-BOX VOLTAGE Detach trigger-box plug. See bottom picture. Ignition ON. Trigger-box-plug voltage.	<div>4 2</div> <div>(+) (-)</div>	Battery voltage
5	PRIMARY-CIRCUIT VOLTAGE Trigger-box plug detached. See bottom picture. Ignition ON. Trigger-box-plug voltage.	<div>1 2</div> <div>(+) (-)</div>	Battery voltage



227 / 1204



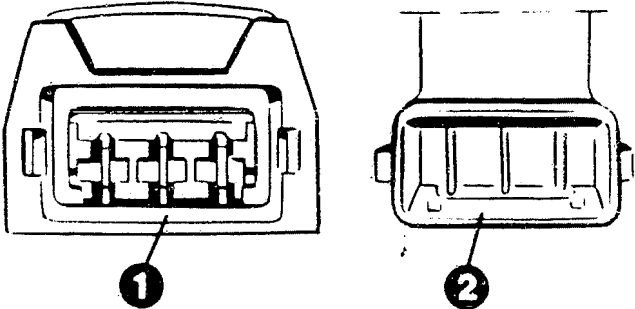
227 / 1204



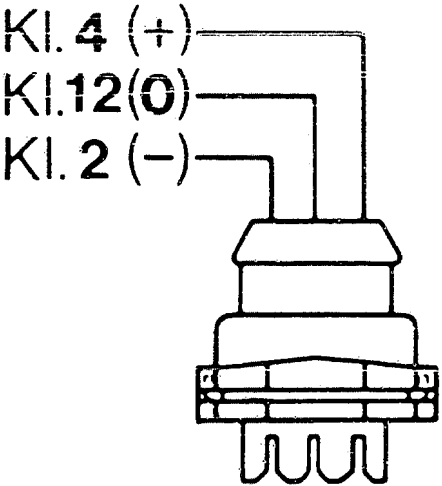
227 / 580

RAPID DIAGNOSIS CHART (CONTINUED)

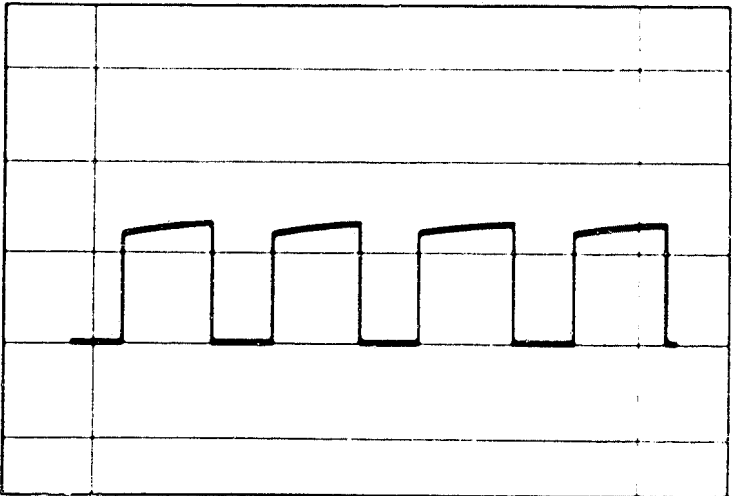
Test step	Testing of component/function Test instructions/conditions	Termin- als	Set values
6	IGNITION-DISTRIBUTOR PLUG AND SOCKET Detach ignition-distributor plug. Visual inspection: Check ignition-distributor plug and socket for oxidation. See top picture.	—	—
7	MAGNETIC-PULSE-GENERATOR VOLTAGE Attach ign.-distributor and trigger-box plug. Push back rubber sleeve of ignition-distributor plug. Ignition ON. Ignition-distributor-plug voltage. See center picture.	4 2 (+) (-)	equal to/greater than 10 V
8	MAGNETIC-PULSE-GENERATOR FUNCTION Oscilloscope "special" to ignition-distributor plug and vehicle ground. See center picture. Start engine.	12 B- (+) (-)	Rectangular pulse (bottom picture)
9	IGNITION-ADVANCE-UNIT FUNCTION Push back rubber sleeve of trigger-box plug. Oscilloscope "special" to trigger-box plug and vehicle ground. Start engine.	5 B- (+) (-)	Rectangular pulse (bottom picture)



227 / 184



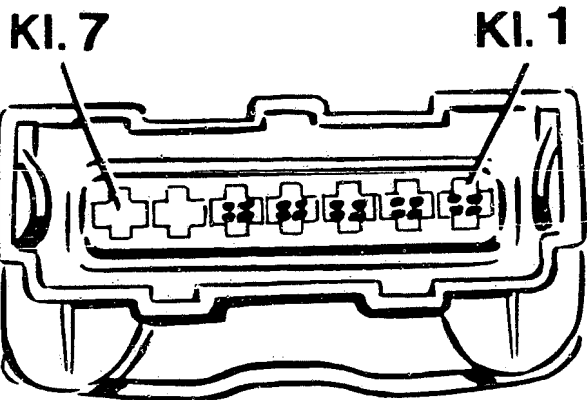
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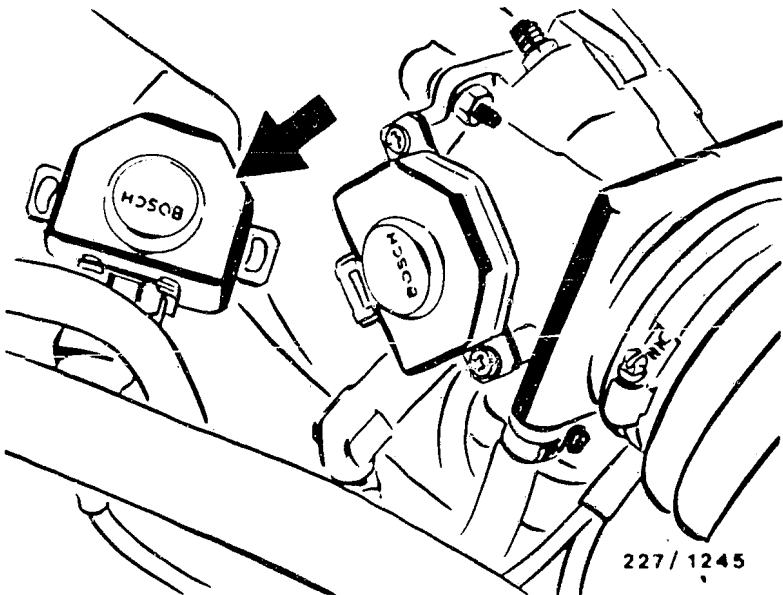
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RAPID DIAGNOSIS CHART (CONTINUED)

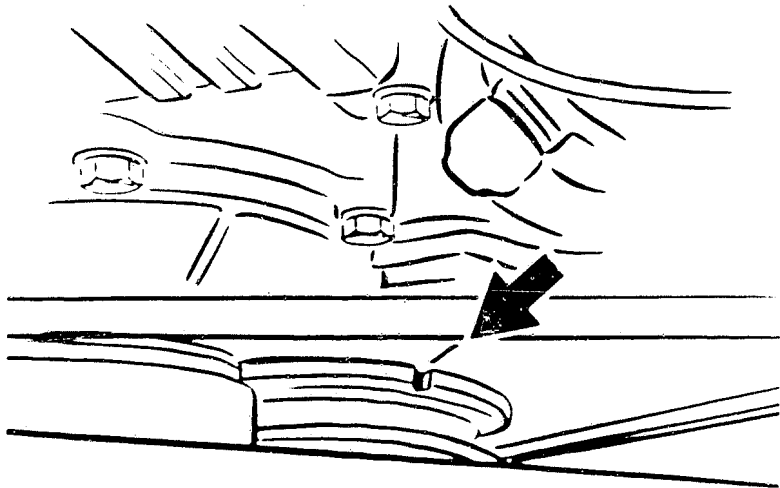
Test step	Testing of component/function Test instructions/conditions	Termi- nals	Set values
10	CONTACT RESISTANCE (PRIMARY SIDE) Detach negative and positive lead from battery. Detach trigger-box plug. See top picture. Ignition ON. Resistance between battery terminal and trigger-box plug.  Resistance between battery term. and ign. coil. Resistance bet. ign. coil and trigger-box plug.	   B+ 4 B- 2  B+ 15 1 1	   max. 0.3 Ω  max. 0.3 Ω
11	PRIMARY SIGNAL Connect negative and positive lead to battery. Attach trigger-box plug. Connect oscilloscope/engine-speed tester to ignition coil.  Start engine.	   15 1 (+) (-)	   Primary voltage/ engine-speed indication (magni- tude irrelevant)
12	BASIC IGNITION SETTING Engine at operating temperature (oil temperature approx. +80°C). Ignition OFF. Connect Motortester in accordance with operating instructions. Detach plug from throttle-valve switch and attach shorting device KDZS 0003 to detached plug. See center picture, arrow. Detach ignition distributor vacuum hose. Run engine at 700...1000 min <sup>-1</sup> . Read off ignition angle/aim lamp at ignition firing point marks (mark corresponds to 10° BTDC). See bottom picture.	          —	          10° ± 2° BTDC



227/580



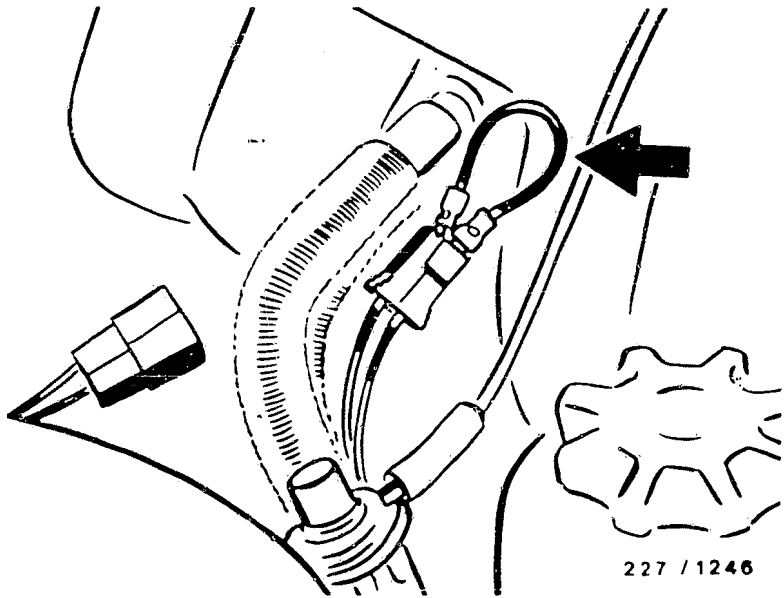
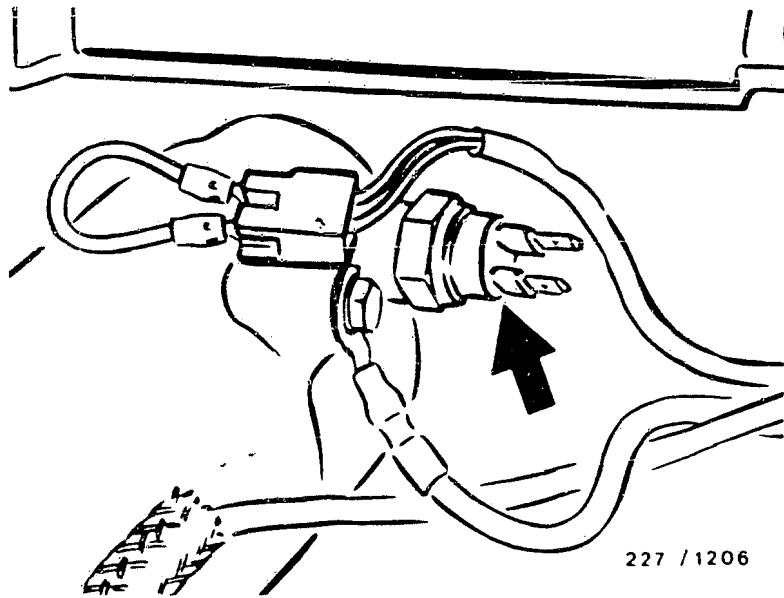
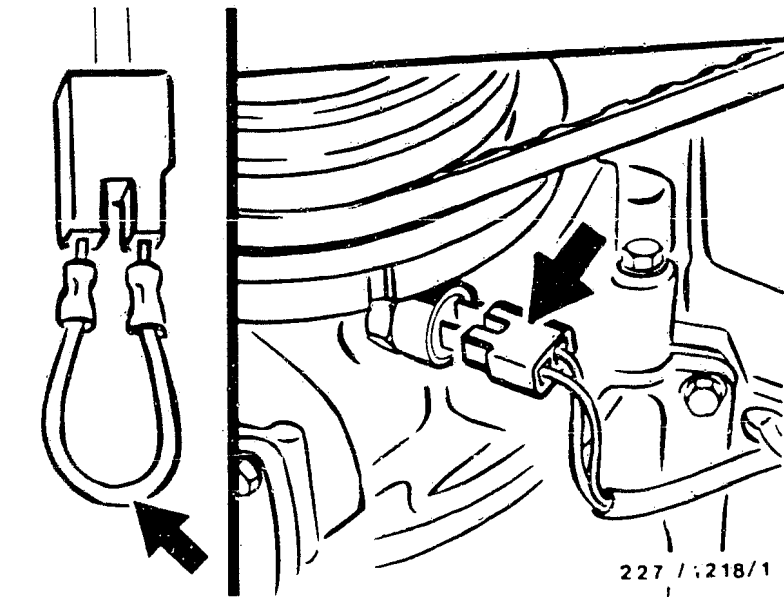
227/1245



227/1203

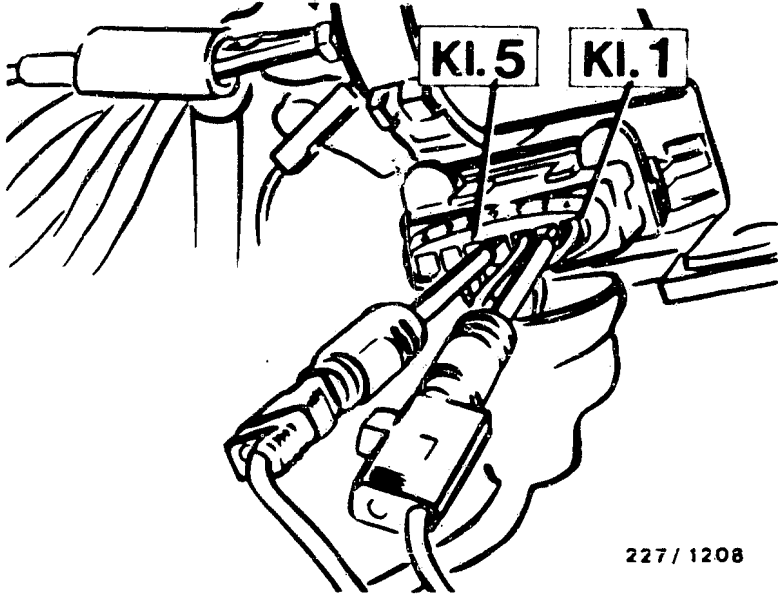
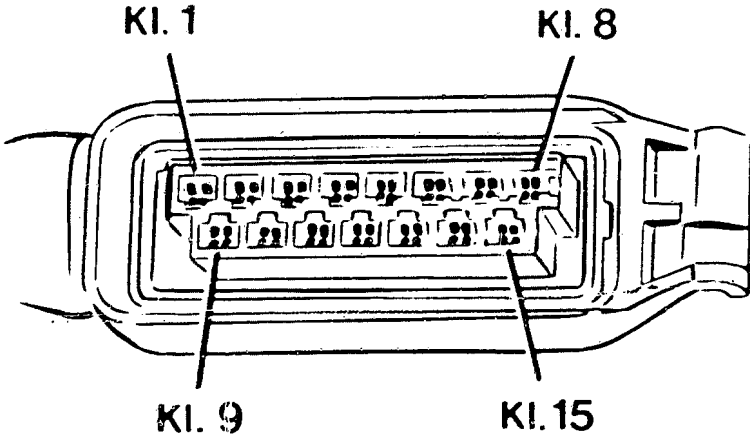
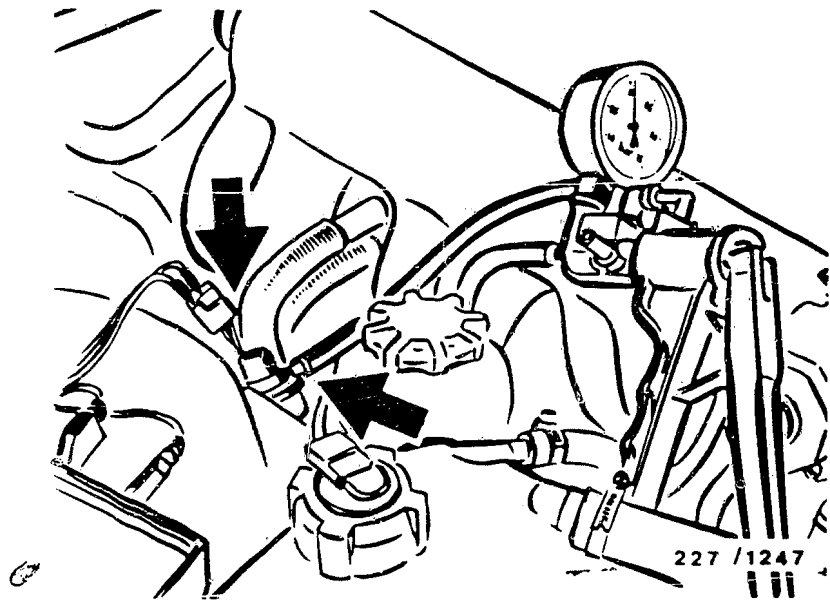
RAPID DIAGNOSIS CHART (CONTINUED)

Test step	Testing of component/function Test instructions/conditions	Termi- nals	Set values
13	CONTROL LEAD, CHARACTERISTIC CURVE CONTROL Detach plug of temperature switch (oil), temperature switch (intake manifold) and part- load switch. Jumper plug in each case with auxiliary lead. See top, center and bottom pictures, arrow. Detach spark-advance-unit plug (not illustrated). Ignition ON. Voltage, spark-advance-unit plug.	3 7 (+) (-)	Battery voltage
14	TEMPERATURE SWITCH (OIL) Temperature-switch plug detached. Resistance, temperature switch. See top picture, arrow.	—	Less than approx. + 65°C Approx. 0 Ω (continuity) Greater than approx. + 65°C Infinity Ω (Open-circuit)
15	TEMPERATURE SWITCH (INTAKE MANIFOLD) Temperature-switch plug detached. Resistance, temperature switch. See center picture, arrow.	—	Greater than approx. + 17°C Approx. 0 Ω (continuity) Less than approx. + 17°C Infinity Ω (Open-circuit)



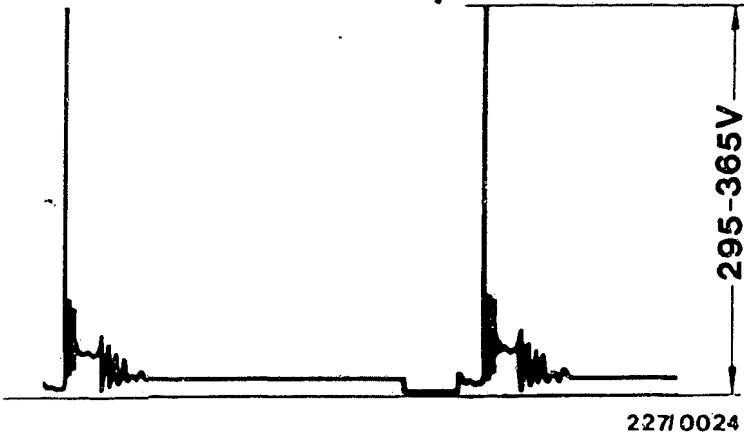
RAPID DIAGNOSIS CHART (CONTINUED)

Test step	Testing of component/function Test instructions/conditions	Termi- nals	Set values
16	<b>PART-LOAD SWITCH</b> Part-load-switch plug detached. Detach vacuum hose at part-load switch and connect vacuum pump to part-load switch. See top picture, arrow. Resistance, part-load switch. See top picture, arrow.	—	Less than approx. 90 mbar Infinity $\Omega$ (Open-circuit) Greater than approx. 90 mbar Approx. 0 $\Omega$ (Continuity)
17	<b>THROTTLE-VALVE SWITCH – IDLE/FULL LOAD</b> Spark-advance-unit plug detached. Voltage, spark-advance-unit plug. See center picture. Throttle valve in idle position. Briefly start engine.  Voltage, spark-advance-unit plug. Fully open throttle valve. Briefly start engine.	<div>61 (+)(-)</div> <div>141 (+)(-)</div>	<div>Approx. battery voltage</div> <div>Approx. battery voltage</div>
18	<b>VOLTAGE, TRIGGER BOX</b> Attach spark-advance-unit plug. Remove ignition-coil/trigger-box combination. Push back rubber sleeve of trigger-box plug. Voltage, trigger-box plug. See bottom picture. Engine idling.	<div>42 (+)(-)</div>	<div>12 – 14 V max. 1 V below U<sub>B</sub></div>



RAPID DIAGNOSIS CHART (CONTINUED)

Test step	Testing of component/function Test instructions/conditions	Termi- nals	Set values
19	VOLTAGE, IGNITION COIL Voltage at ignition coil and battery.  Engine idling.	15 B- (+) (-)	Equal to/greater than 10 V
20	PRIMARY VOLTAGE Connect oscilloscope with pulse-shaping circuit to ignition coil. Engine idling.	15 1 (+) (-)	295 - 365 V (See top picture)



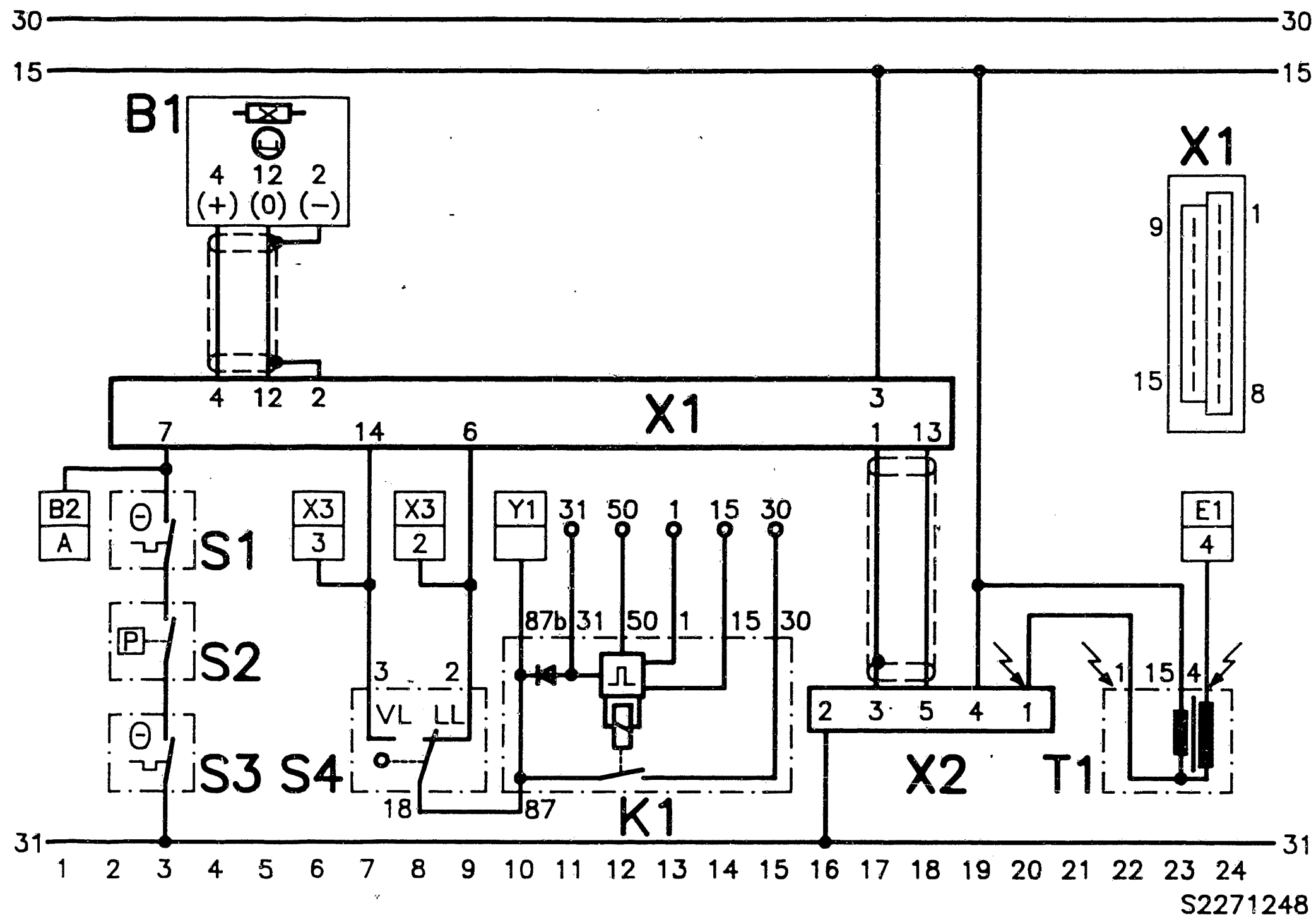
# TEST SPECIFICATIONS

Ignition coil, primary	0.6...1.0 $\Omega$
Ignition coil, secondary	6.4...11.1 k $\Omega$
Ignition-distributor as-installed setting	Cyl. 1 10° BTDC ID mark
Voltage, trigger box with ignition ON	Battery voltage
Voltage, primary circuit with ignition ON	Battery voltage
Voltage, magnetic pulse generator with ignition ON	Equal to/greater than 10 V
Magnetic-pulse-generator function at cranking speed	Rectangular pulse
Spark-advance-unit function at cranking speed	Rectangular pulse
Contact resistance Supply leads	
Trigger box	Max. 0.3 $\Omega$
Primary circuit	Max. 0.3 $\Omega$
Engine-speed signal at cranking speed	Rectangular pulse
Primary signal at cranking speed	Primary voltage/ engine-speed indication
Basic ignition setting	
Engine oil temperature approx.+ 80° C	
Throttle-valve-switch plug jumpered with KDZS 0003.	
Detach vacuum hose, ignition distributor.	
Engine speed 700-1000 min <sup>-1</sup>	10° $\pm$ 2° BTDC

# TEST SPECIFICATIONS (CONTINUED)

Control lead, characteristic curve control with ignition ON	Battery voltage
Temperature switch (oil)	Less than approx. + 65°C Approx. 0 $\Omega$ (continuity) Greater than approx. 65°C Infinity (open-circuit)
Temperature switch (intake manifold)	Greater than approx. + 17°C Approx. 0 $\Omega$ (continuity) Less than approx. + 17°C Infinity $\Omega$ (open-circuit)
Part-load switch	Less than approx. 90 mbar Infinity $\Omega$ (open-circuit) Greater than approx. 90 mbar Approx. 0 $\Omega$ (cont.)
Throttle-valve switch at cranking speed	
Idle setting	Approx. battery voltage
Full-throttle setting	Approx. battery voltage
Voltage, trigger box with engine idling	12...14 V max. 1 V below U <sub>B</sub>
Voltage, ignition coil with engine idling	Equal to/greater than 10 V
Primary voltage with engine idling	295...365 V

Please refer to SIS Jetronic microcard or Autodata test specifications for settings as regards idle speed, exhaust gas, valve clearance etc.



# ELECTRICAL TERMINAL DIAGRAM

High-tension arrows: caution 400 V...25 kV

B1 = Magnetic pulse generator (ignition distributor)

B2 = to idle-speed regulator

E1 = to ignition distributor

K1 = Control relay (LE-Jetronic)

S1 = Temperature switch (intake manifold)

S2 = Part-load switch

S3 = Temperature switch (oil)

S4 = Throttle-valve switch

T1 = Ignition coil

X1 = Spark-advance-unit plug

X2 = Trigger-box plug

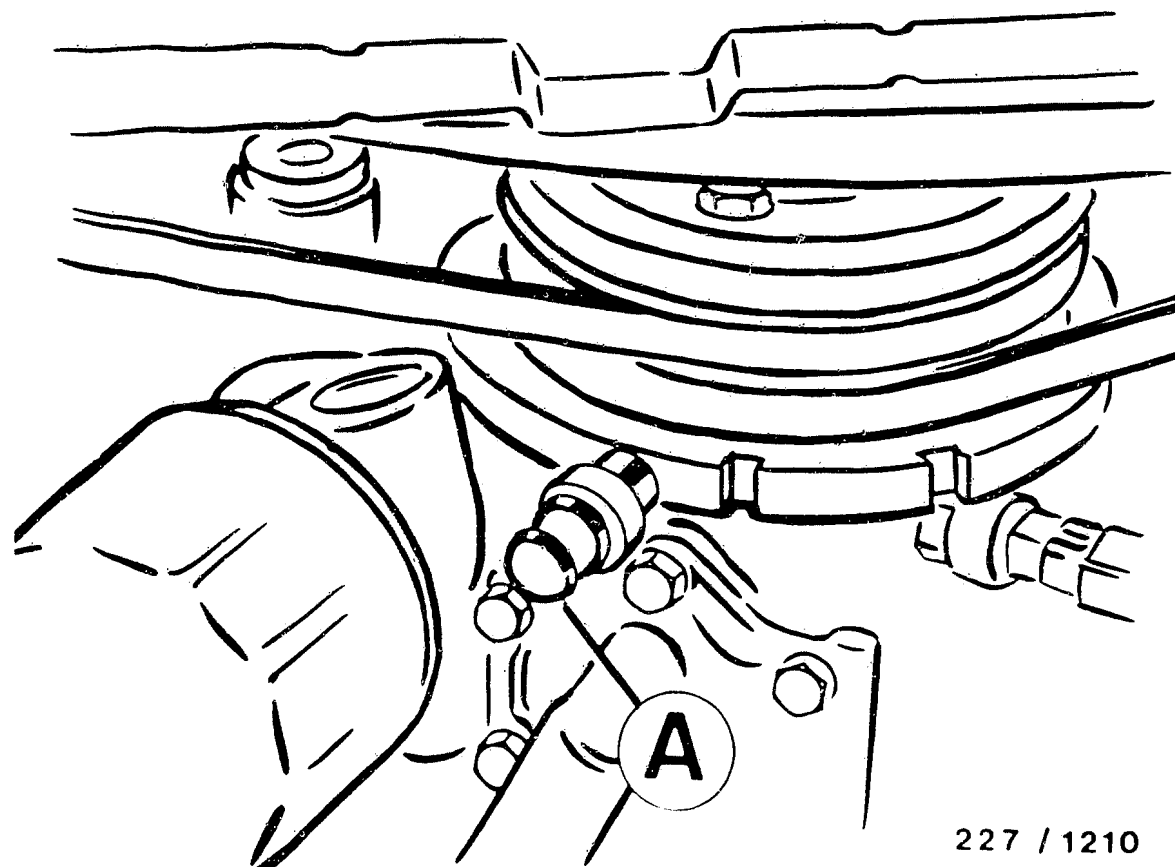
X3 = LE-Jetronic control-unit plug

Y1 = Electric fuel pump

G21

G22



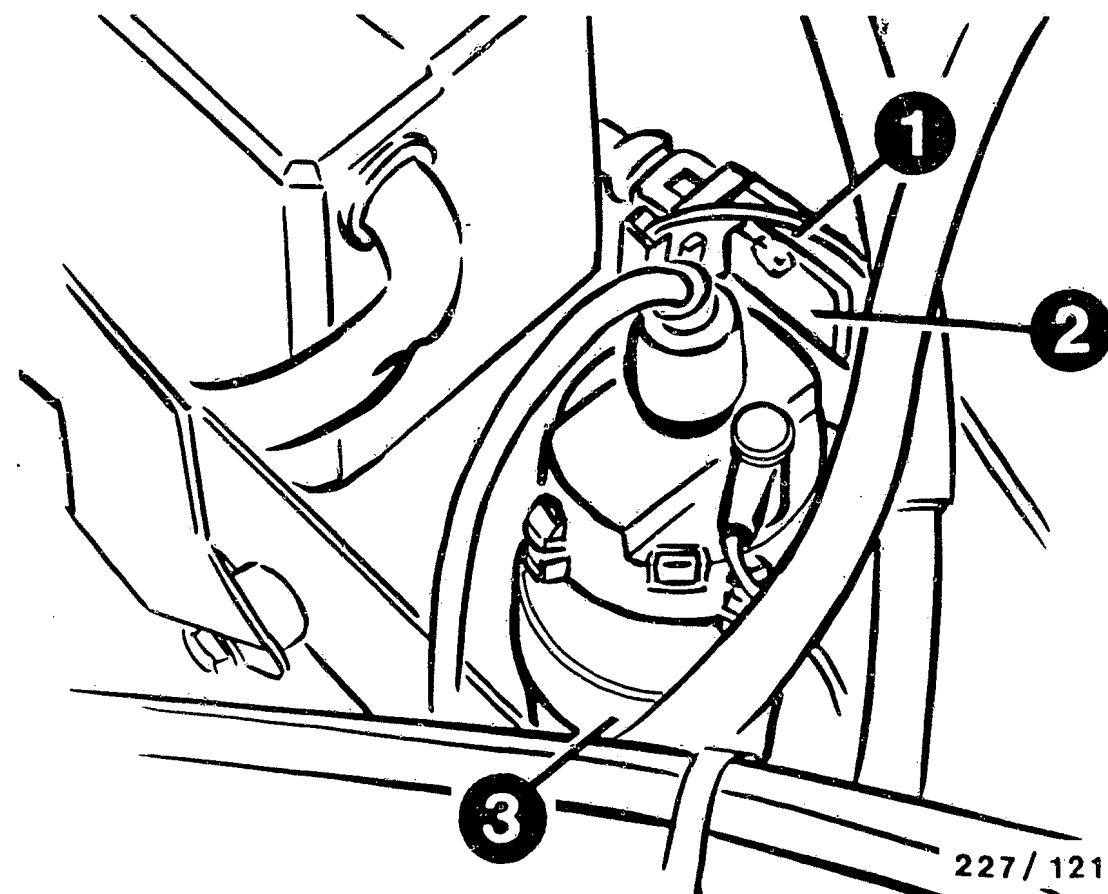


227 / 1210

A = Plug for TDC sensor

#### INSTALLATION POSITION OF COMPONENTS

Motortester (TDC sensor) connection:  
Remove plug "A" (see picture) and insert TDC sensor as far as it will go into sleeve of control housing.

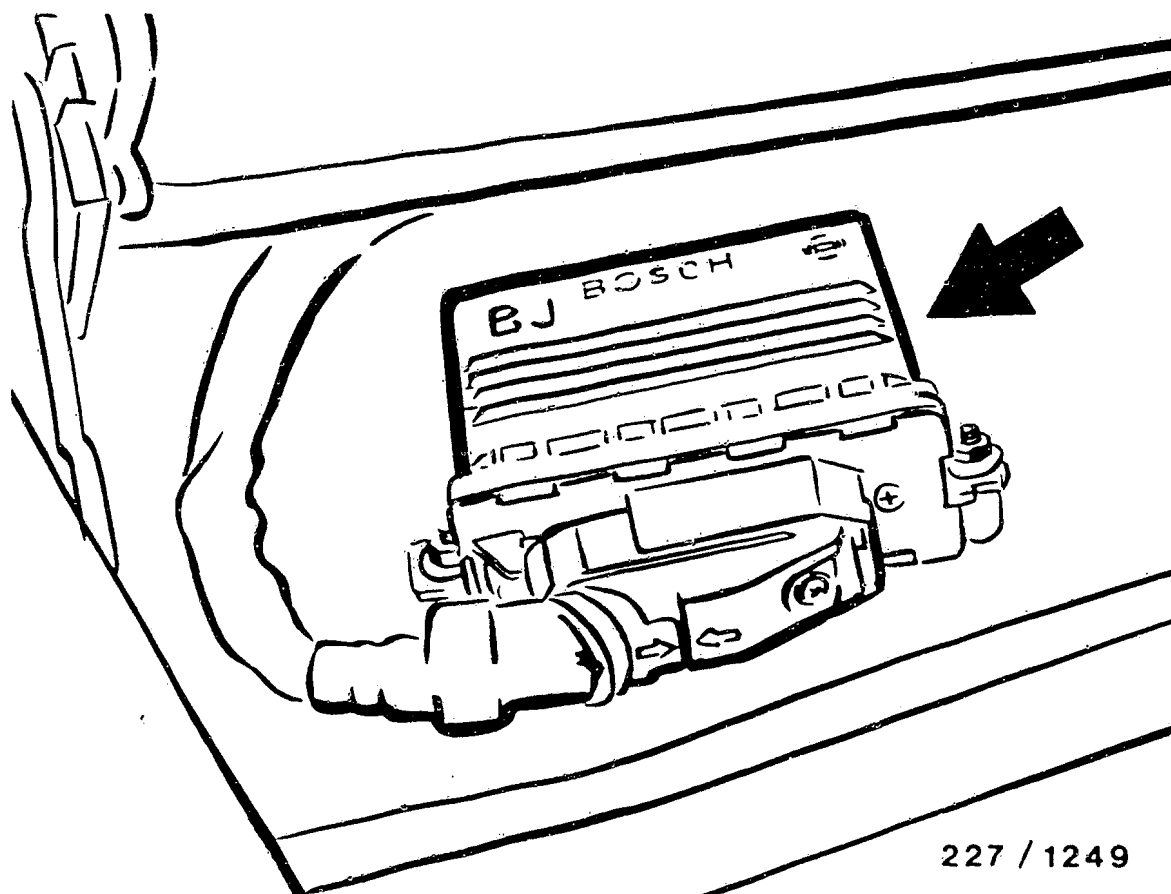


227 / 1211

- 1 = TI trigger box
- 2 = Heat sink
- 3 = Ignition coil

#### INSTALLATION POSITION OF COMPONENTS (CONTINUED)

The trigger box and ignition coil are installed on a joint heat sink. See picture.



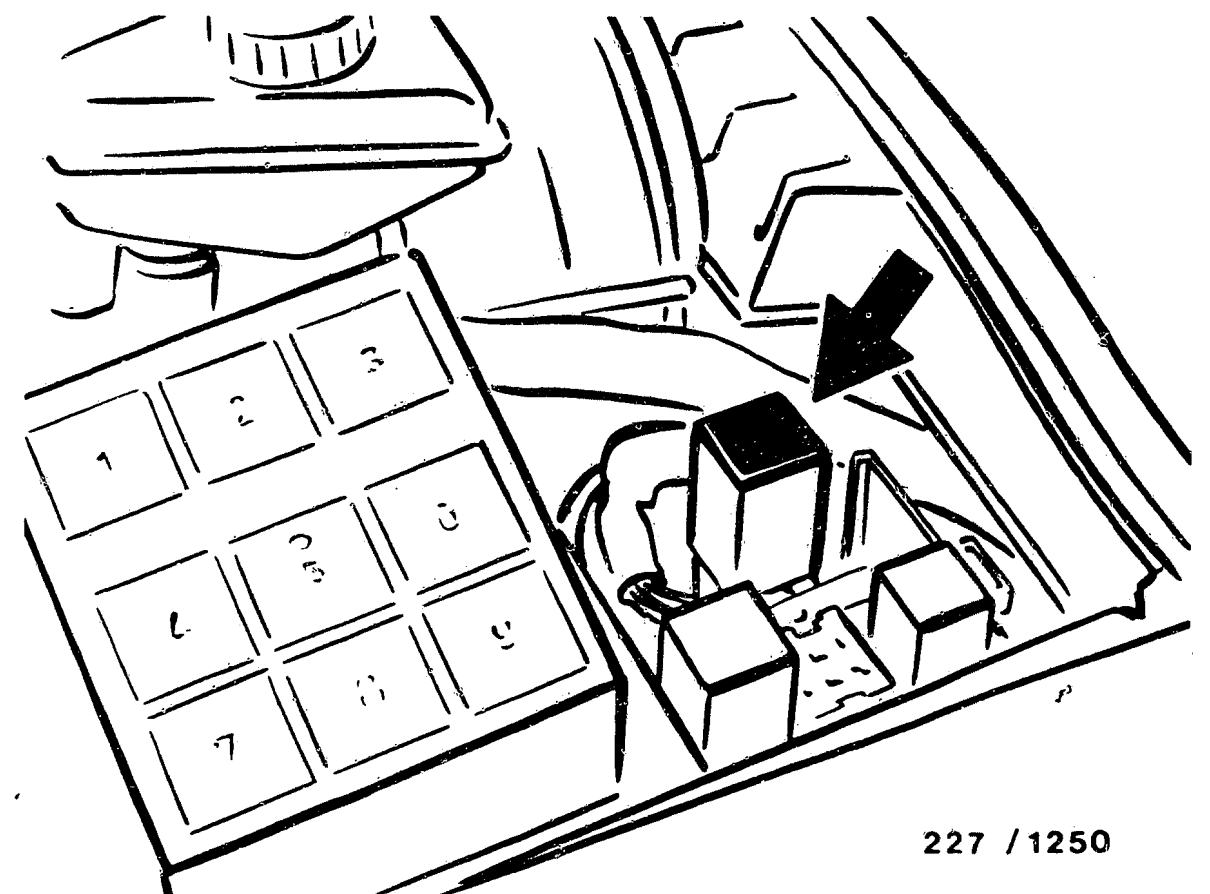
Arrow = Ignition advance unit

#### INSTALLATION POSITION OF COMPONENTS (CONTINUED)

The ignition advance unit is located on the right-hand side of the vehicle. See picture.

#### Removal:

Raise cover of plenum chamber.  
Unscrew fastening nuts.  
Press back retaining spring, tilt and remove plug.



Arrow = Control relay (LE-Jetronic)

#### INSTALLATION POSITION OF COMPONENTS (CONTINUED)

The control relay is located in the relay holder (on left of engine compartment). See picture, arrow.  
Note: Control relay may have been fitted in relay holder in differing sequence (characteristic feature, black frame).

# INSTALLATION POSITION OF COMPONENTS (CONTINUED)

- \* Throttle-valve switch is located at throttle-valve assembly.
- \* Temperature switch (oil) is located at front left of engine (crankshaft pulley).
- \* Temperature switch (intake manifold) is located at intake manifold, rear.
- \* Part-load switch is located in engine compartment (wheelhouse, right).

For production reasons:  
continued on the following  
coordinate.

Trouble-shooting instructions : OPE-5019  
BOSCH system : ABS  
Make of vehicle : OPEL  
Basic microcard : PKW-048

## TABLE OF CONTENTS

Section	Coordinates
Special features .....	02
Structure, usage .....	02
Safety and precautionary measures .....	02
Test requirements .....	03
Rapid diagnosis chart .....	05
Test specifications .....	17
Electrical terminal diagram .....	19
Installation position of components, notes on removal and installation .....	21

## SPECIAL FEATURES

This microcard, valid at the time of publication, contains trouble-shooting instructions for the following models:

- \* OPEL Vectra 2,0i 10.1988->
- \* OPEL Vectra 4x4 01.1989->
- \* ABS with 4 wheel-speed sensors and 4 hydraulic channels.
- \* Sensor ring gear with 43 teeth.
- \* The fuse (F19) must be removed when testing brakes and performance of Vectra 4x4 on test bench. The rear axle is then disconnected from the drive train.

## STRUCTURE, USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

For a detailed description of trouble-shooting, see the basic instructions.

### ATTENTION :

The set values, terminal assignments and special features of these vehicle-specific brief instructions are always binding.

## SAFETY AND PRECAUTIONARY MEASURES

\*For reasons of safety, the hydraulic modulator must not be repaired, but may be exchanged only as a complete unit.

Exception: relays

\*Do not loosen any screws on the hydraulic modulator! Danger of fatal accident owing to failure of the brakes.

\*Take great care when handling brake fluid. Poison!

For further information, see brief instructions.

## PREREQUISITES FOR TESTING WITH ABS 2-LED TESTER

- \* Regulation tire size fitted ?
- \* Check tightness of ground connection of return pump.
- \* Check ground connection of over-voltage protection relay term. 31 for tightness and corrosion.
- \* Check tightness of ground strap between engine block and vehicle frame.
- \* Check hydraulic connections at hydraulic modulator and sealing points for leaks (visual inspection).
- \* If the ABS warning lamp lights up from time to time when driving (e.g. after switching on loads) and goes out again automatically, check battery and voltage supply (alternator, regulator and voltage dips).
- \* Check following items if ABS warning lamp lights up all the time and does not go out:
  - Is controller plug properly connected to controller and engaged ?
  - All plug contacts O.K. ?
  - Spring contacts engaged ?
  - Check correctness of installation position of sealing ring in controller plug: curvature downwards.
  - Check proper assignment of wheel-speed-sensor leads at controller plug:

### Wheel-speed sensor:

Front left to term. 5 and term. 4.  
Front right to term. 11 and term. 21.  
Rear left to term. 7 and term. 9.  
Rear right to term. 24 and term. 26.  
Rear axle to term. - and term. -.

### Wheel-speed sensor:

on Vectra 4x4

front left to term. 22 and term. 4.

- V-belt snapped?  
(No voltage supply from alternator, charge indicator lamp and ABS warning lamp light up).
- \* Connect ABS 2-LED tester to ABS wiring harness.
- Only detach and connect controller with ignition switched off.
- For test purposes, switch on ignition in all program-selector-switch positions (tester uses power supply from vehicle battery).
- Observe LED (green) for power supply in all program-selector-switch positions.

## I M P O R T A N T !

Never drive with tester connected !

Brake system must be bled before carrying out ABS test.  
Do not actuate ABS tester during bleeding process.

The entire test program is to be repeated whenever repairs have been performed.

The anti-lock braking system is a vehicle safety system.  
Work on this system requires detailed system knowledge.  
The conventional brake system must be in proper working order.

### General notes on trouble-shooting:

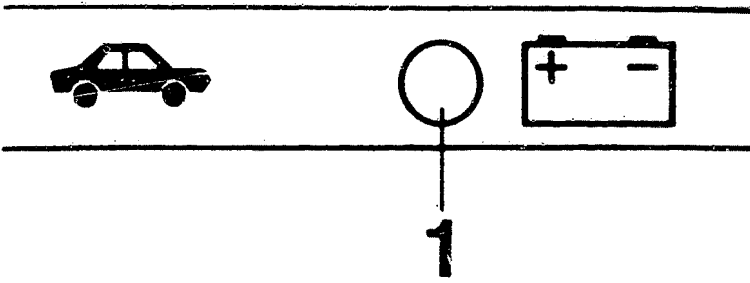
Check all leads for short-circuit to ground and contact with positive leads as well as for wear and pinching.

RAPID DIAGNOSIS CHART

Do not drive with tester connected. Are all test conditions met?

Program-switch positions 1 to 6

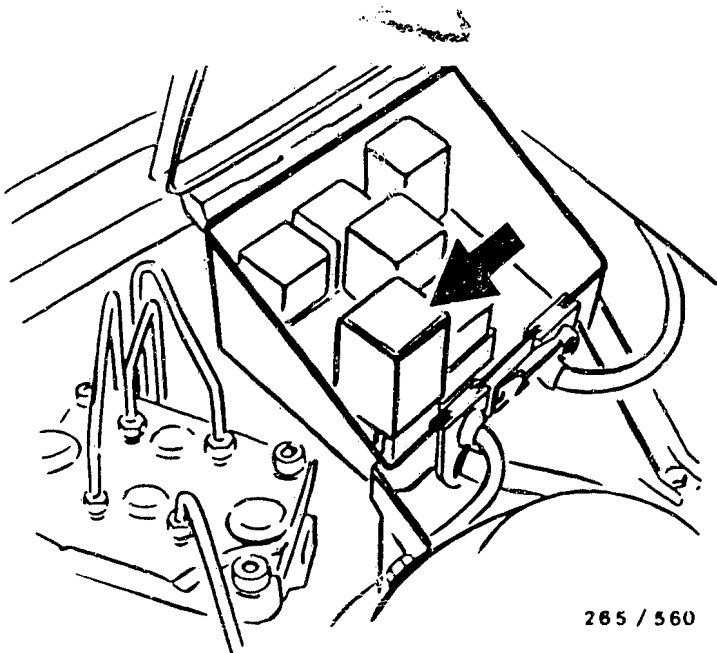
Testing of (measurement at terminals)	Additional operation	Test specifi- cation (reading)	Possible causes of faults
Power supply  (term.1 und term.20)	Ignition on	LED 1 (top picture) continuously lit	<ul style="list-style-type: none"><li>*Battery insufficiently charged</li><li>*High voltage drops</li><li>*Overvoltage-protection relay defective</li><li>*Check lead to ignition and starting switch, term. 15</li></ul>



265 / 242

1 = LED for supply voltage

Arrow = Overvoltage-protection relay

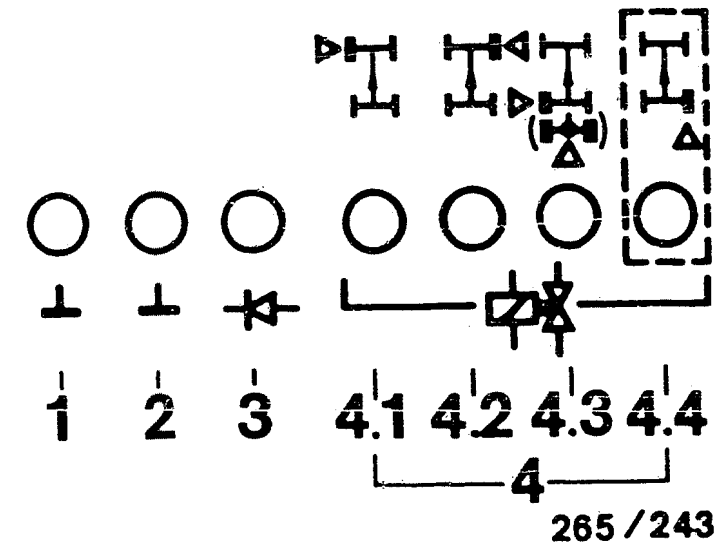


265 / 560

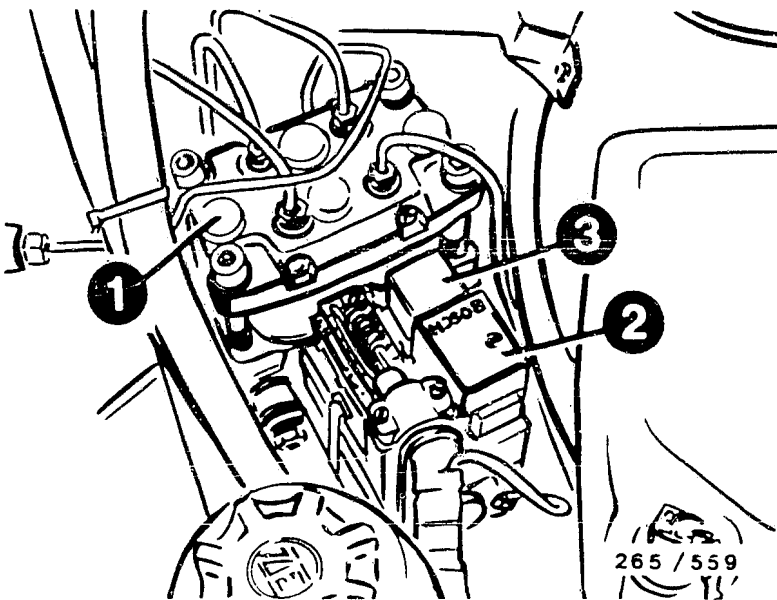
RAPID DIAGNOSIS CHART (CONTINUED)

Program-switch position 1 (4-channel hydraulic modulator)

Testing of (measurement at terminals)	Addition- al operation	Test specifi- cation (reading)	Possible causes of faults
Ground connection (term.10, term.34)  Diode for warning lamp (term.29, term.32) Solenoid-operated valve internal res. (term.2, term.18, term.19, term.35)  Off-position and ground connection of relay  ABS warning lamp	Ignition on	7 LED (1 to 4.4)  simultaneously brightly lit (top picture)  ABS warning lamp in vehicle must light up	<ul style="list-style-type: none"><li>* LED 1 and/or 2 (top picture) not lit: Check ground terminals for open circuit.</li><li>* LED 3 (top picture) not lit: Diode defective, check ground connection of valve relay.</li><li>* One or more LEDs 4 not lit: Check corresponding plug-in connection for solenoid-operated valve and leads.</li><li>Solenoid-operated valve internal resistance 0,7...1,7 Ω</li><li>* All LEDs 4 and LEDs 3 not lit: Check ground connection of valve relay, valve relay defective.</li><li>* Dimmer lighting-up of an LED means contact resistance in the corresponding circuit.</li><li>* ABS warning lamp not lit: Warning lamp defective. Note: all other 6 LEDs lit.</li></ul>



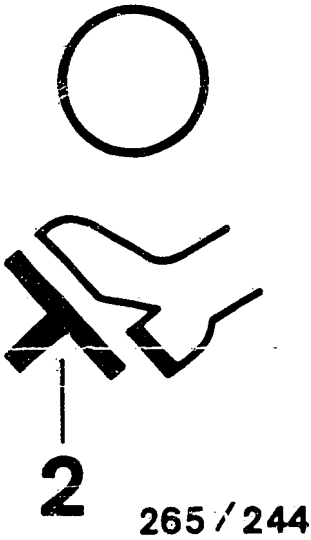
- 1 = Hydraulic modulator
- 2 = Motor relay
- 3 = Valve relay



RAPID DIAGNOSIS CHART (CONTINUED)

Program-selector-switch position 2

Under test (Measurement at the terminals)	Addition- al operation	Test specifi- cation (reading)	Possible causes of trouble
Alternator voltage from term. 61/D+ (term. 15)	Ignition on	LED 1 (top picture) lit.	* In some cases, LED does not go out until after burst of throttle (test is O.K. in this case).
	Start engine	LED 1 (top picture) goes out when engine running	* Test lead and signal from alternator term. 61/D+  * Alternator defective.
Stop-lamp switch (term. 25)	Ignition on	LED 2 (top picture) lit	* Stop-lamp switch defective.  * Check lead to stop-lamp switch.
	Press brake pedal	LED 2 (top picture) goes out	* Lead incorrectly connected to to stop-lamp switch.

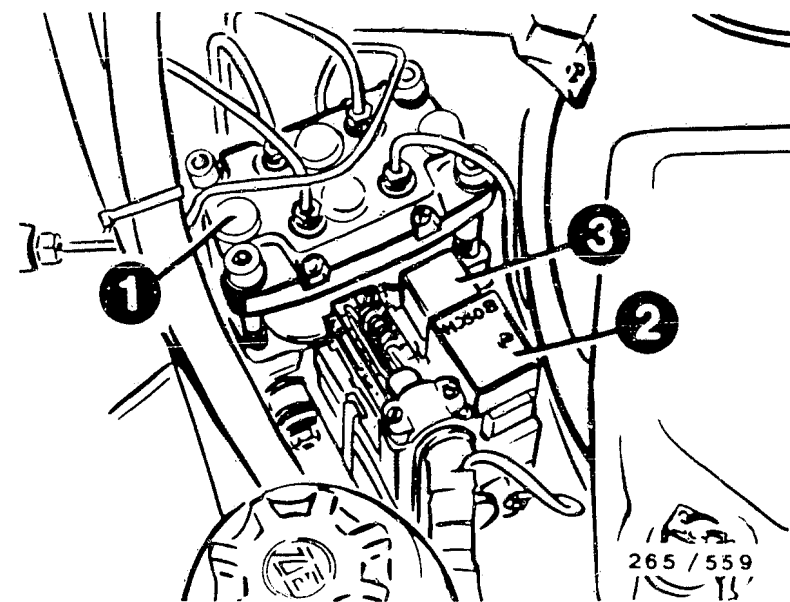
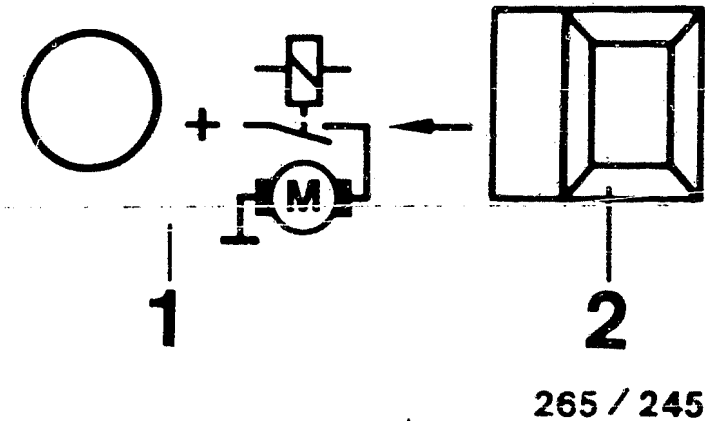




RAPID DIAGNOSIS CHART (CONTINUED)

Program-selector-switch position 3

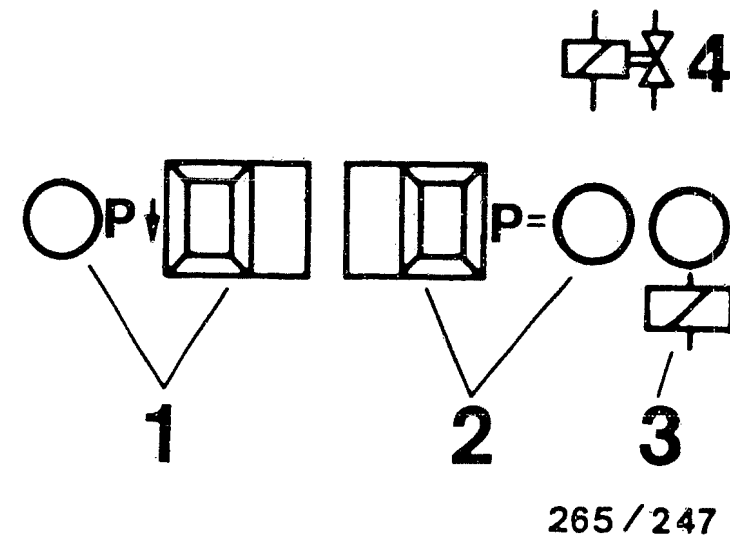
Under test (Measurement at the terminals)	Additional operation	Test specification (reading)	Possible causes of trouble
Motor relay (2), pump motor in hydraulic modulator (1) (t.28 and t.14) (center picture)	Ignition on, press button 2 constantly (top picture)	LED 1 lights up, pump motor runs.  After releasing button, LED continues to light up due to run-on of motor (top picture).	<ul style="list-style-type: none"><li>* Motor relay defective</li><li>* Check ground connection and positive terminal of pump motor</li><li>* Check following leads:  From controller t.14 and t.28 to hydraulic modulator t.9 and t.11 . Positive leads to hydraulic modulator t.2 and t.13.</li><li>* Pump motor or hydraulic modulator defective.</li></ul>



Program-selector-switch position 4 not applicable.

Program-selector-switch position 5 (4-channel hydraulic modulator)

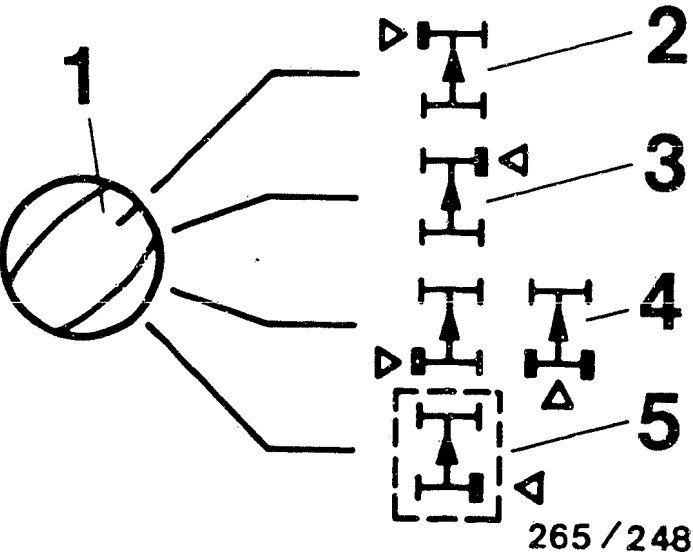
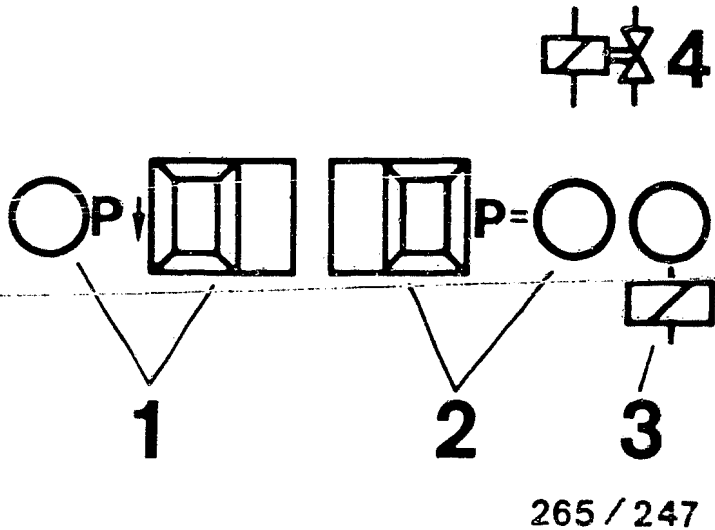
Under test (Measurement at the term.)	Additional operation	Test specifi- cation (reading)	Possible causes of trouble
Valve-relay function (t.27)	Ignition on	LED 3 (bottom picture) lights up	<ul style="list-style-type: none"><li>* Valve relay (winding) or leads defective</li></ul>



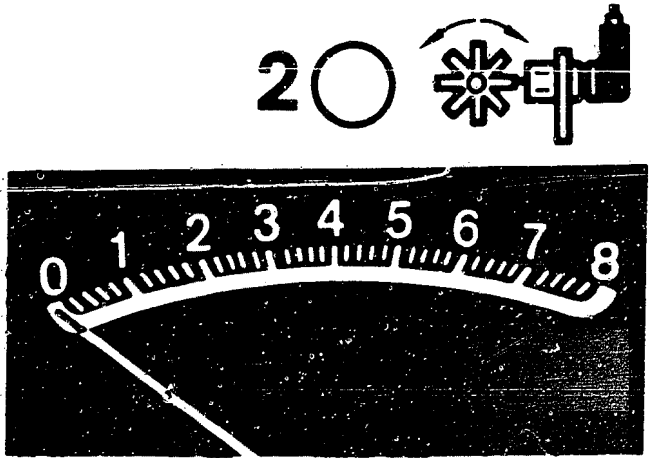
Program-selector-switch position 5 (continued) see next Coordinate!

RAPID DIAGNOSIS CHART (CONTINUED)  
Program-selector-switch position 5 (4-channel hydraulic modulator)

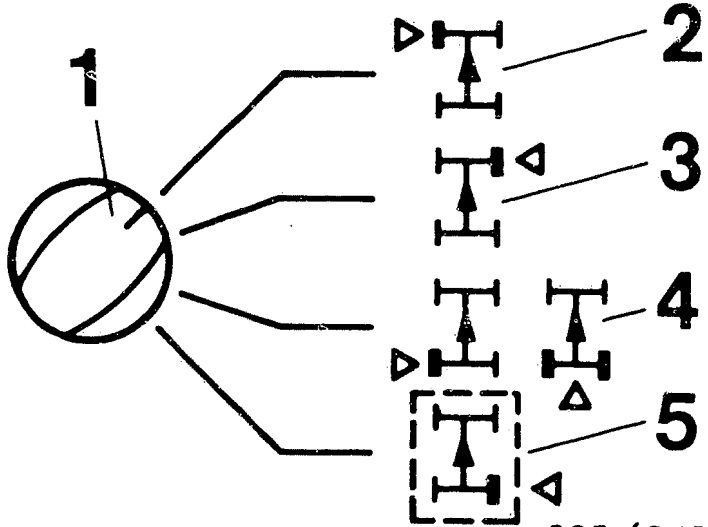
Under test (measurement at the terminals)	Additional operation	Test specification (reading)	Possible causes of trouble
Check solenoid valves in hydrau- lic modulator for proper function and mix-ups. NOTE: Perform test consecutively for each individual wheel. Stick to sequence of operations!	Jack up vehicle. Ignition on. It must be possible to turn the wheel to be tested freely by hand. Set switch 1 for wheel selection to the wheel to be tested. (Bottom picture) Selector lever on "N" with automatic transmission; on idle with manupl. transmission.		<ul style="list-style-type: none"><li>* Repeat test with engine running</li><li>* Valve relay (make contact) defective</li><li>* Open-circuit in lead from valve relay term. 87 to B+</li><li>* Brake lines at hydraulic modulator mixed up</li></ul>
Constant pressure function	1. Press button P= (top picture) constantly	LED P= (top picture) lights up	<ul style="list-style-type: none"><li>* Current value is not reach- ed (LED P arrow or P= go out; top picture): battery not sufficiently charged. Repeat test with engine running.</li></ul>
	2. Press brake pedal constantly	Wheel can be turned by hand	
	3. Release button P= (top picture)	LED P= goes out (top picture) Wheel locks	
Pressure reduction function	4. Press button P arrow (top picture)	LED P arrow (top picture) lights up, wheel can be turned by hand	<ul style="list-style-type: none"><li>* Proper electrical connec- tions for solenoid valves? Wheel, front left: t. 2 Wheel, fr. right: t.35 Wheel, rear left: t.18 Wheel, rear right: t.19 Rear axle: t.-</li><li>* Hydraulic modulator defective</li></ul>
	5. Release button P arrow (top picture)	LED P arrow (top picture) goes out, wheel locks	
	6. Release brake pedal		



Prüfung von (Messung an den Klemmen)	Zusätzliche Bedienung	Prüfwert (Anzeige)	Mögliche Fehlerursachen
<p>Drehzahlgeber auf Funktion und Vertauschung</p> <p>HINWEIS: Prüfung nach – einander für jedes Rad einzeln durch- führen.</p> <p>Rad vorne links: Kl.5 und Kl.4</p> <p>bei Vectra 4x4 Kl.22 und Kl.4</p> <p>Rad vorne rechts: Kl.11 und Kl.21</p> <p>Rad hinten links: Kl.7 und Kl.9</p> <p>Rad hinten links: Kl.24 und Kl.26</p>	<p>Fahrzeug hoch- bocken. Zündung ein.</p> <p>Das zu prüfende Rad muß von Hand frei drehbar sein.</p> <p>Bei der Prüfung der angetriebenen Achse muß das nicht geprüfte Rad fest- gehalten werden.</p> <p>Schalter für Rad- anwahl auf das zu prüfende Rad ein- stellen (Bild unten)</p> <p>Rad von Hand drehen bis LED 2 über dem Instrument ohne zu flackern auf- leuchtet. (Drehzahl ca.1 Um- drehung pro Sekunde). Danach Anzeige am Instrument ab – lesen : (Bild oben)</p>	<p>1.Kleinste An- zeige größer 1,6 Skalenteile</p> <p>2.Zulässige Schwankungs- breite max. 25 % von größtem Anzeigewert.</p>	<p>*Drehzahlgeberleitung vertauscht</p> <p>*Drehzahlgeberleitung unterbrochen</p> <p>*Drehzahlgeber defekt Wicklungswiderstand Vorderachse: 600...1600 Ω Hinterachse: 600...1600 Ω</p> <p>*Luftspalt zwischen Dreh- zahlgeber und Zahnkranz zu groß</p> <p>*Zahnkranz defekt (z.B. korrodiert, verschmutzt) oder lose</p> <p>*Zahnkranz mit falscher Zähnezahl eingebaut Vorderachse: 43 Zähne Hinterachse: 43 Zähne</p> <p>*Radlagerspiel zu groß</p> <p>*Anzeige vorhanden, LED2 leuchtet nicht auf: Wackelkontakt in Dreh- zahlgeberleitung.</p>



265 / 249

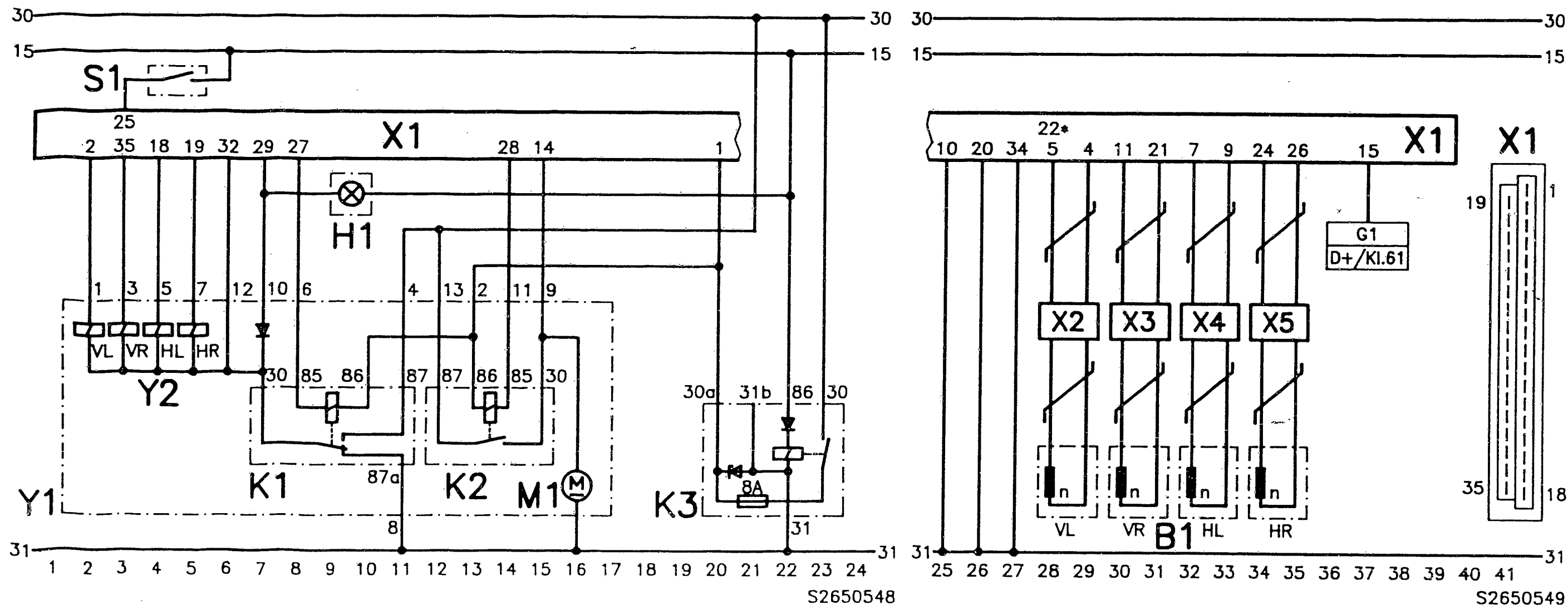


265 / 248

TEST SPECIFICATIONS

Wheel-speed sensor		
* Winding resistance at ambient temperature (-10°C...+120°C) for front axle:	600...1600	Ω
rear axle:	600...1600	Ω
Hydraulic-modulator solenoid valves		
* Winding resistance at ambient temperature (-10°C...+120°C):	0,7...1,7	Ω
Tightening torque for		
* Fastening screws of wheel-speed sensors:	> 8	Nm
* Brake-line connections at hydraulic modulator:	12...16	Nm
Number of teeth		
* front axle:	43	teeth
* rear axle:	43	teeth

For production reasons:  
continued on the following  
coordinate.



# ELECTRICAL TERMINAL DIAGRAM

B1 = Wheel-speed sensor

G1 = to alternator

H1 = ABS warning lamp

K1 = Valve relay

K2 = Motor relay

K3 = Over-voltage protection relay

\* = With Vectra 4x4 the terminal at the wheel-speed sensor VL changes from term.5 to term.22

M1 = Return pump motor

S1 = Stop-lamp switch

X1 = Controller plug (35-pole)

X2...X5 = Multiple butt connectors

Y1 = Hydraulic modulator

Y2 = Solenoid valves

VL = front left

VR = front right

H = rear axle

HL = rear left

HR = rear right

H19

H20

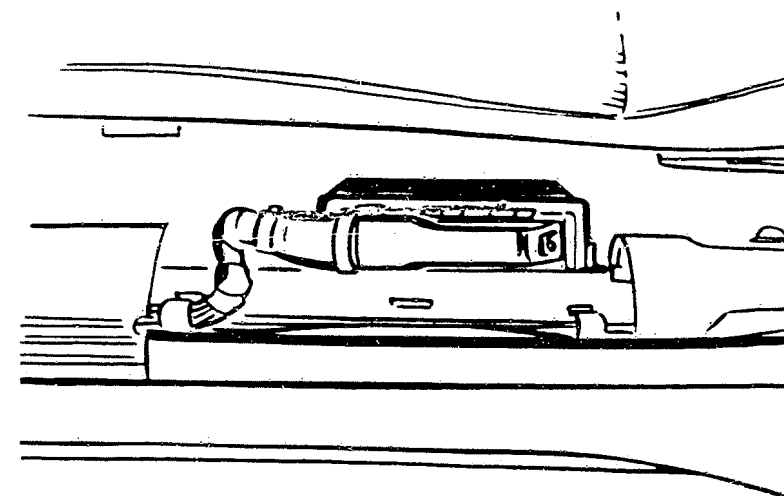
H21

## INSTALLATION POSITION OF COMPONENTS

The installation positions always refer to the direction of travel.

\* Controller:

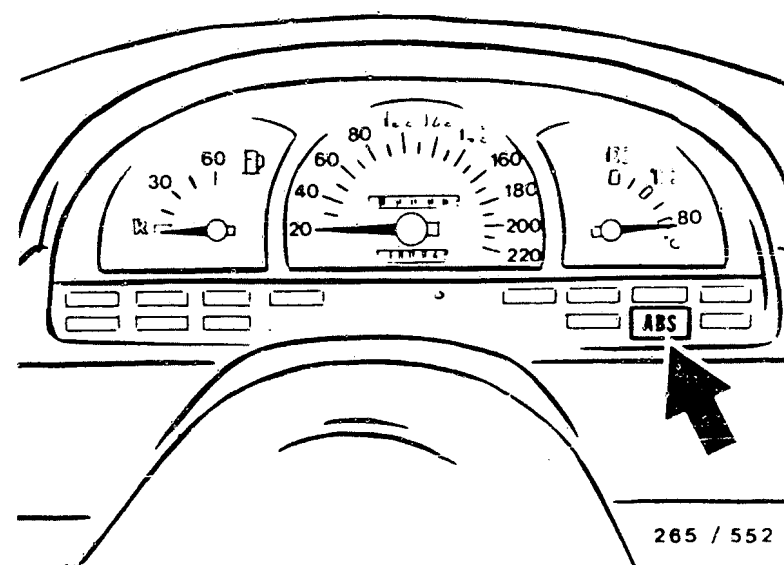
Fitted on left-hand side at sill (top picture).



265 / 551

\* ABS warning lamp:

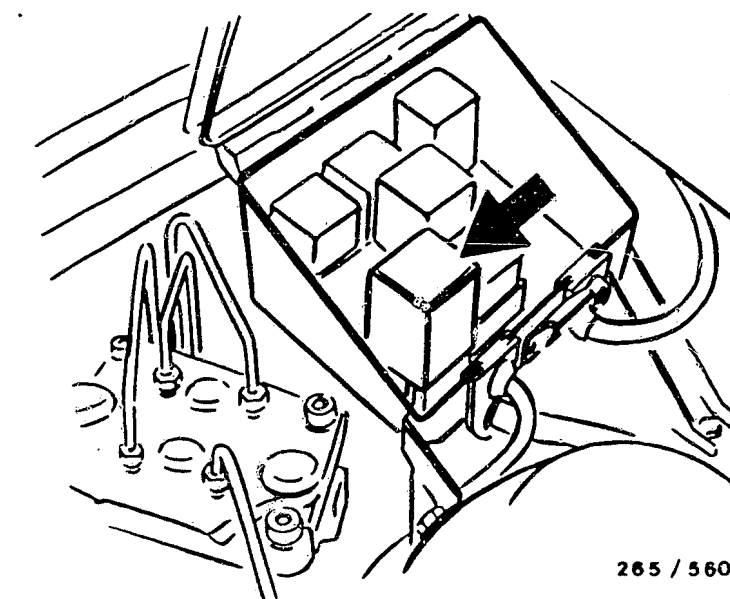
2nd indicator lamp (center picture) from right in instrument panel in indicator-lamp strip.



265 / 552

\* Over-voltage protection relay:

On left in engine compartment in vicinity of bulkhead in relay box (arrow); (bottom picture).

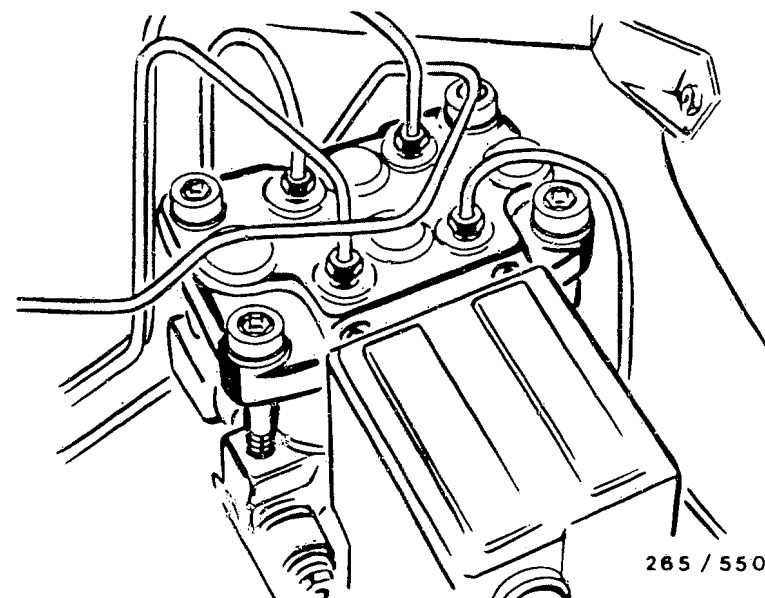


265 / 560

## INSTALLATION POSITION OF COMPONENTS (CONTINUED)

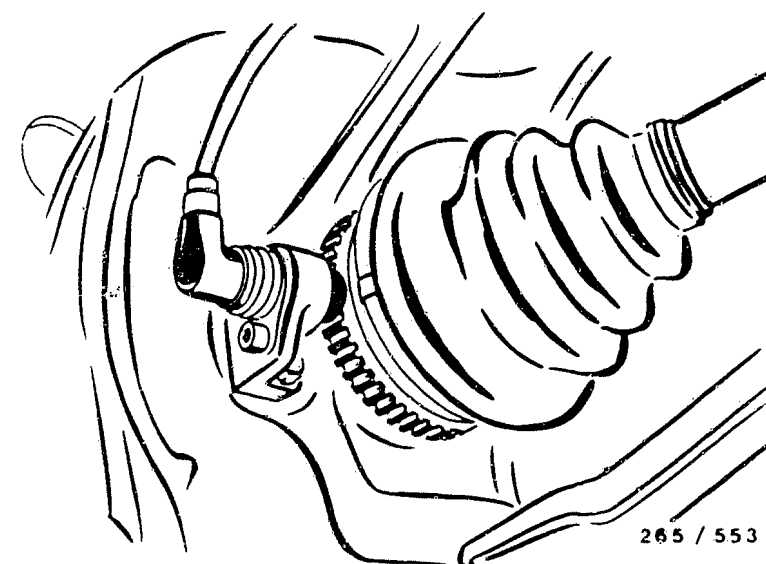
### \* Hydraulic modulator:

In front left of engine compartment (top picture).



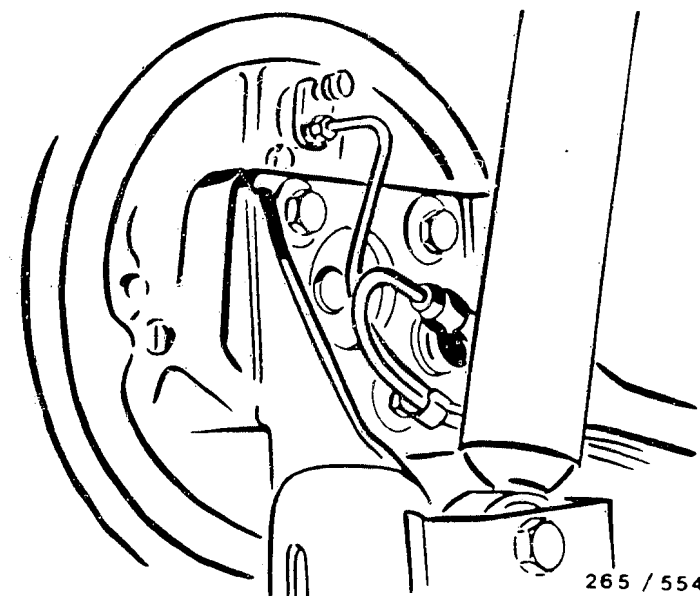
### \* Wheel-speed sensor, front axle:

One wheel-speed sensor each on left and right at steering knuckle (center picture). Wheel-speed sensors cannot be adjusted.



### \* Wheel-speed sensor, rear axle:

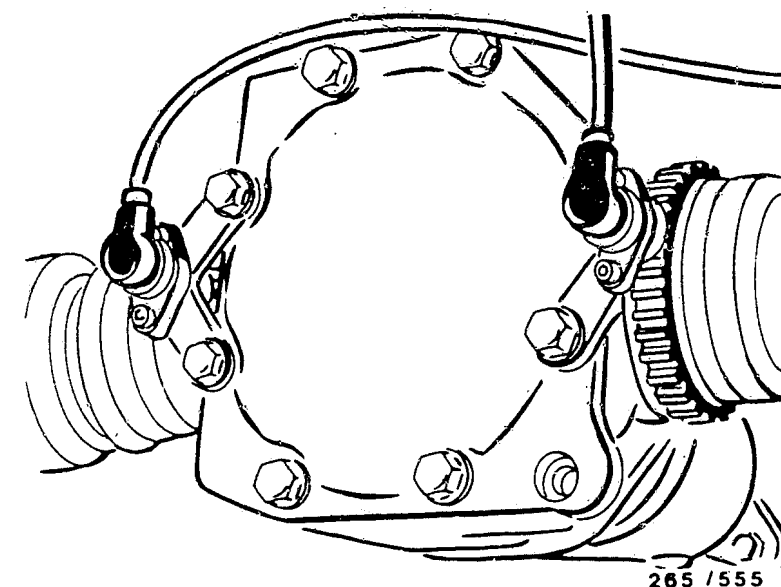
One wheel-speed sensor each on left and right at rear axle (bottom picture). Wheel-speed sensors cannot be adjusted.



## INSTALLATION POSITION OF COMPONENTS (CONTINUED)

### \* Wheel-speed sensor, rear axle (Vectra 4x4 only):

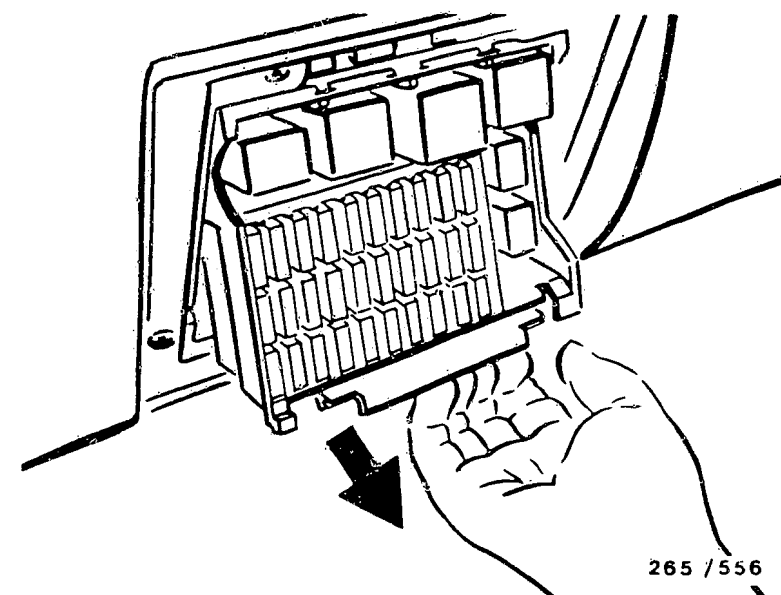
One each on left and right at differential, (top picture)



### \* Fuse box:

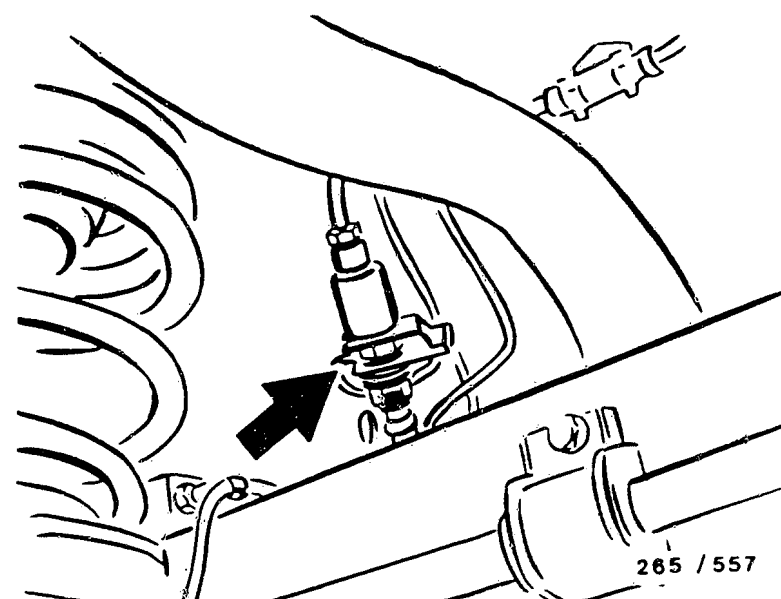
On left beneath instrument panel

Fuse F19 for disconnecting the 4-wheel drive is located in the center row of fuses (second from right), (center picture).

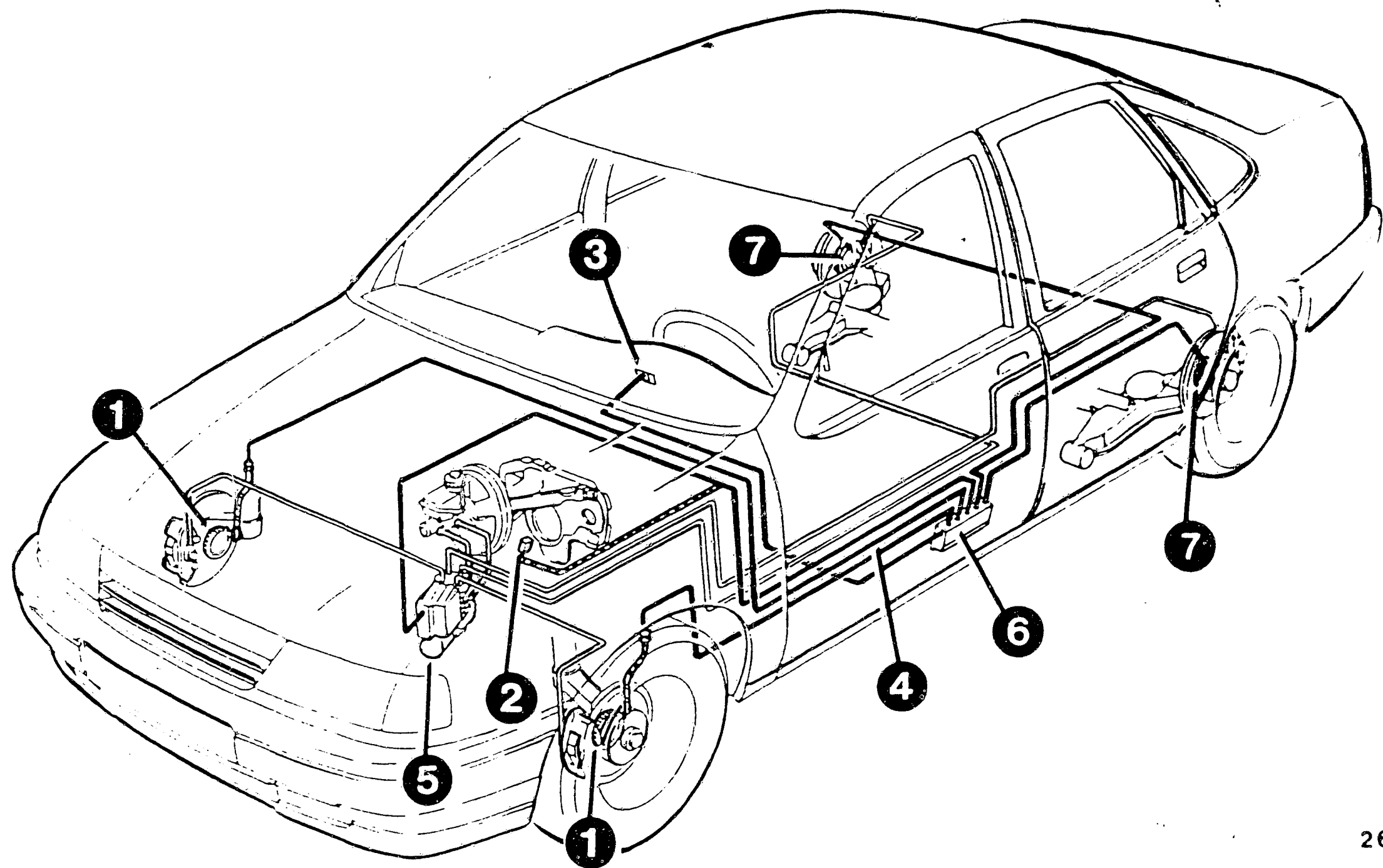


### \* Brake pressure regulator:

One each on left and right above rear axle at vehicle underbody (bottom picture).







265 / 558

# INSTALLATION POSITION OF COMPONENTS (CONTINUED) Vectra 2.0 i

- 1 = Wheel-speed sensor, front axle
- 2 = Over-voltage protection relay
- 3 = ABS warning lamp
- 4 = ABS wiring harness

- 5 = Hydraulic modulator
- 6 = ABS controller
- 7 = Wheel-speed sensor, rear axle

Trouble-shooting instructions : PEU-5010  
BUSCH system : EI-K  
Make of vehicle : PEUGEOT  
Basic microcard : PEU-505

TABLE OF CONTENTS

Section	Coordinate
Special features, usage, safety .....	02
Trouble-shooting chart .....	05
Self-diagnosis test table .....	07
Rapid diagnosis chart .....	11
Test specifications .....	21
Electrical terminal diagram .....	23
Installation position of components, removal and installation instructions .....	27

SPECIAL FEATURES

These brief instructions, valid at the time of publication, apply to the following Peugeot model:

Peugeot 505 Turbo Injection  
with 2.2 l/ 4 cyl. engine  
EU/US 07.87 ->

Electronic ignition system with knock control and boost-pressure control (EI-K).

- \* EI-K control unit 0 227 400 128 with self-diagnosis (knock control only).
- \* Trigger box 0 227 100 123 (with current limitation).
- \* Ignition coil 0 221 122 317
- \* Coolant temperature sensor (twin NTC ).
- \* Boost-pressure control (with frequency valve).
- \* Boost-pressure switch.
- \* Knock sensor 0 261 231 006 (new version)  
No measurement of internal resistance as per basic instructions.
- \* Self-diagnosis with two-digit flashing code.

N o t e :

The flashing code is only output at engine speeds < 1550 min<sup>-1</sup> .  
At engine speeds > 1550 min<sup>-1</sup> a fault is indicated by the lamp lighting continuously.

The fault is indicated by way of the LED in the instrument panel as follows:

Example: Flashing code 2 3  
The LED flashes as follows:  
2 x flash, brief pause, 3 x flash, long pause.

The flashing code is repeated until the ignition is switched off.

## STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.  
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

For production reasons:  
continued on the following  
coordinate.

## SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

CAUTION!  
High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

- Starting motor operates, engine fails to start or starts only with difficulty.
- Engine starts but then dies.
- Idle problems (engine speed, exhaust gas).
- Poor throttle take-up, flat spot during acceleration.
- Engine missing (ignition, injection).
- Maximum engine power/top speed not reached.
- Fuel consumption too high.
- Engine running on.
- Engine pinging/knocking.
- Engine overheating.
- Fault lamp.

Cause (component fault)									
									* Self-diagnosis
*	*	*	*	*	*				High-tension side
*	*	*	*	*					Ignition coil
*	*								Firing sequence
*									Voltage, EI-K control unit
*									Voltage, trigger box
*									Voltage, primary circuit
*									Magnetic pulse generator, voltage supply
*									Magnetic pulse generator, function
*									EI-K control unit function
*									Engine speed (Jetronic)
*									Contact resistances
*									Primary signal
*									Ignition-distributor as-installed setting
*									Peak-coil-current cutoff
									* Fault lamp

TROUBLE-SHOOTING CHART (CONTINUED)

Customer complaint (fault symptoms)

- Starting motor operates, engine fails to start or starts only with difficulty.
- Engine starts but then dies.
- Idle problems (engine speed, exhaust gas).
- Poor throttle take-up, flat spot during acceleration.
- Engine missing (ignition, injection).
- Maximum engine power/top speed not reached.
- Fuel consumption too high.
- Engine running on (dieseling).
- Engine pinging/knocking.
- Engine overheating.
- Fault lamp.

Cause (component fault)									
	*	*	*	*	*		*	*	Coolant temperature sensor
	*	*	*	*	*		*	*	Throttle-valve switch - idle
							*	*	Boost-pressure switch
	*	*		*	*		*	*	Basic ignition setting
				*	*		*		Fuel enrichment
		*	*	*	*		*	*	Frequency valve
			*						Voltage, trigger boxes with engine idling
			*						Voltage, ignition coil with engine idling
			*						Primary voltage with engine idling

## SELF-DIAGNOSIS TEST TABLE

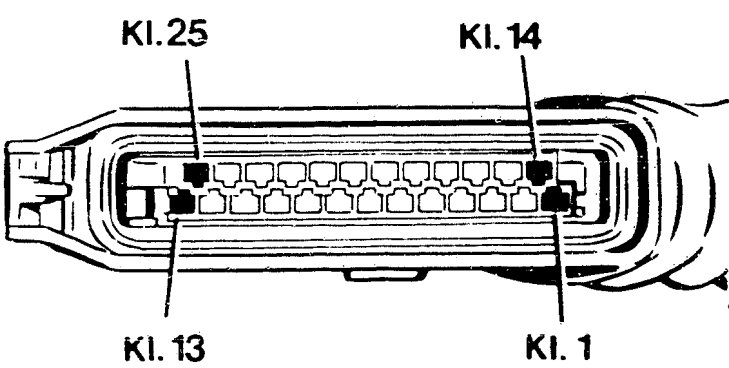
Fault indication Flashing code	Cause of trouble	Test instructions	Terminals	Set values
1 1	Sustained knocking	Test cooling system, test ignition-distributor as-installed setting. Fuel with too low an octane number. Test frequency valve of exhaust turbo-supercharger. Bearing damage or abnormal engine noise.	—	—
1 2	EI-K control unit Voltage supply	Voltage, EI-K control unit plug with handle cover removed. Engine idling.	6 20 (+) (-)	equal to/greater than 10,5 V
2 1 / 2 2	Knock sensor	Visual inspection, knock-sensor-plug oxidation. Tightening torque		15...25 Nm
2 3	EI-K control unit	Knock control defective, renew EI-K control unit.	—	—
3 1	No LU-Jetronic load signal	Dwell angle, EI-K control unit plug and vehicle ground. Engine idling. Briefly accelerate to full throttle. Detach EI-K and Jetronic control-unit plug. Resistance, EI-K control unit plug and Jetronic control-unit plug. Resistance, EI-K control unit plug and vehicle ground.	8 B- (+) (-)  8 6 8 B-	Read off dwell angle Change in dwell angle 0 Ω > 1 M Ω
3 2	Excessive load signal from LU-Jetronic	Detach EI-K and Jetronic control-unit plug. Voltage, EI-K control unit plug and vehicle ground. Ignition ON.	8 B- (+) (-)	0 V

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

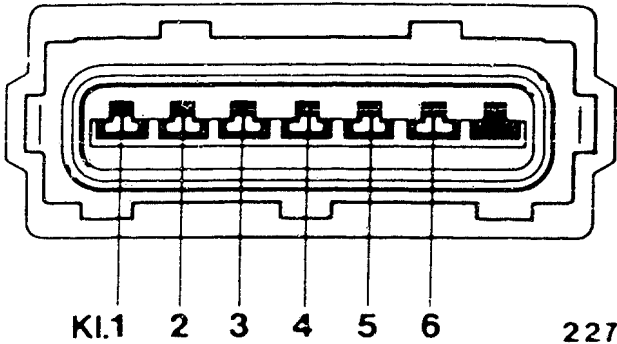
Fault indication Flashing code	Cause of trouble	Test instructions	Termi- nals	Set values
4 1	Rotational-angle sensor Input voltage too low	EI-K control unit plug detached. 1. Short-circuit to ground, voltage, EI-K control unit plug and battery. 2. Attach EI-K control unit plug. Voltage, rotational-angle-sensor plug connection. Ignition ON. 3. Voltage, rotational-angle-sensor plug connection. (multiply value determined under 2. by 0.165, adjust rotational-angle sensor if necessary).  Note: For measurements of Items 2 and 3, only use voltmeter with $R_i > 100 \text{ k } \Omega / \text{V}$ and resolution 10 mV.	22 B+ (-) (+)  21 23 (+) (-) 22 23 (+) (-)	0 V  3,5...4,5 V Measured voltage from Item 2 x 0.165
4 2	Rotational-angle sensor Input voltage too high	Throttle valve in idle position. EI-K control unit plug detached. Resistance, EI-K control unit plug. Resistance, EI-K control unit plug. Voltage, rotational-angle-sensor plug connection.	21 23 22 23 22 B- (+) (-)	3,2...4,8 k $\Omega$ 500...810 $\Omega$ 0 V
5 1	Resistance, temperature sensor (coolant)	EI-K control unit plug detached. Resistance, EI-K control unit plug and vehicle ground.  Coolant temperature: + 20° C + 30° C + 80° C + 90° C + 100° C	25 B-	2,1...2,9 k $\Omega$ 1,4...2,0 k $\Omega$ 280...370 $\Omega$ 210...280 $\Omega$ 160...210 $\Omega$

RAPID DIAGNOSIS CHART

Test step	Testing of component/function Test instructions/conditions	Termi- nals	Set values
1	HIGH-TENSION SIDE  Test function for example of spark plugs, ignition harness and distributor cap (e.g. open-circuit, shunt). Assess for example by way of ignition oscillogram, resistance measurement, visual inspection.	—	—
2	IGNITION COIL  Visual inspection: plug present, sealing compound oozed out? Primary resistance. Secondary resistance.	1 15 1 4	0,7... 1,2 $\Omega$ 6,9...11,9 k $\Omega$
3	VOLTAGE, EI-K CONTROL UNIT PLUG  Detach EI-K control unit plug. Voltage, EI-K control unit plug. See top picture. Ignition ON.	6 14 (+) (-)	Battery voltage
4	VOLTAGE, TRIGGER BOX  Detach trigger-box plug. Voltage, trigger-box plug. See bottom picture. Ignition ON.	4 2 (+) (-)	Battery voltage
5	VOLTAGE, PRIMARY CIRCUIT  Voltage, trigger-box plug. Ignition ON.	1 2 (+) (-)	Battery voltage



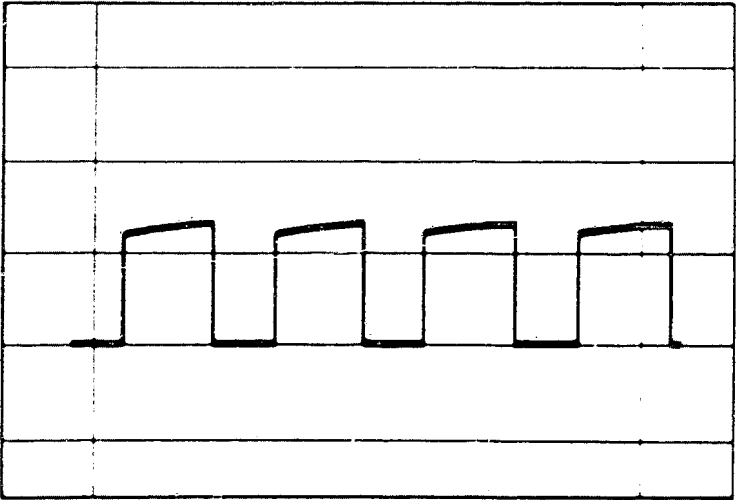
227 / 321



227/925

RAPID DIAGNOSIS CHART (CONTINUED)

Test step	Testing of component/function Test instructions/conditions	Termi- nals	Set values
6	MAGNETIC PULSE GENERATOR  Visual inspection, ignition-distributor plug and socket, "oxidation"	_____	_____
7	MAGNETIC PULSE GENERATOR, VOLTAGE SUPPLY  Voltage, ignition distributor plug. Ignition ON.	4 10 (+) (-)	equal to/greater than 10 V
8	MAGNETIC PULSE GENERATOR, FUNCTION  Connect oscilloscope "special" to ignition-distributor plug and vehicle ground. Actuate starting motor. See top picture.	24 B- (+) (-)	Rectangular pulse
9	EI-K CONTROL UNIT FUNCTION  Ignition OFF. Attach EI-K control unit plug. Connect oscilloscope "special" to trigger-box plug. Actuate starting motor. See top picture.	5 B- 6 B- (+) (-)	Rectangular pulse
10	ENGINE-SPEED SIGNAL (JETRONIC)  Ignition OFF. Detach Jetronic control-unit plug. Connect oscilloscope "special" to Jetronic control-unit plug. Actuate starting motor. See top picture.	1 B- (+) (-)	Rectangular pulse

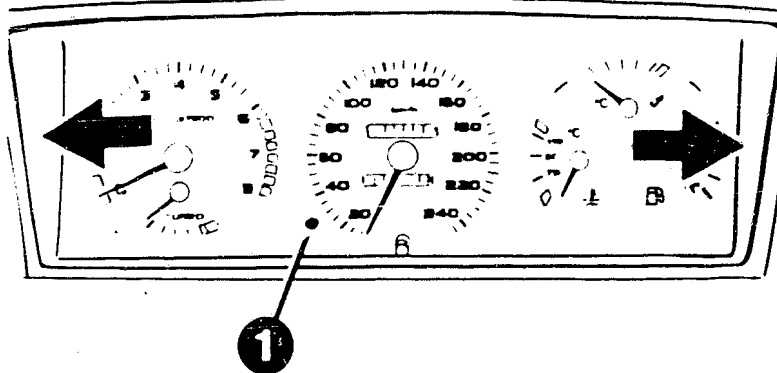
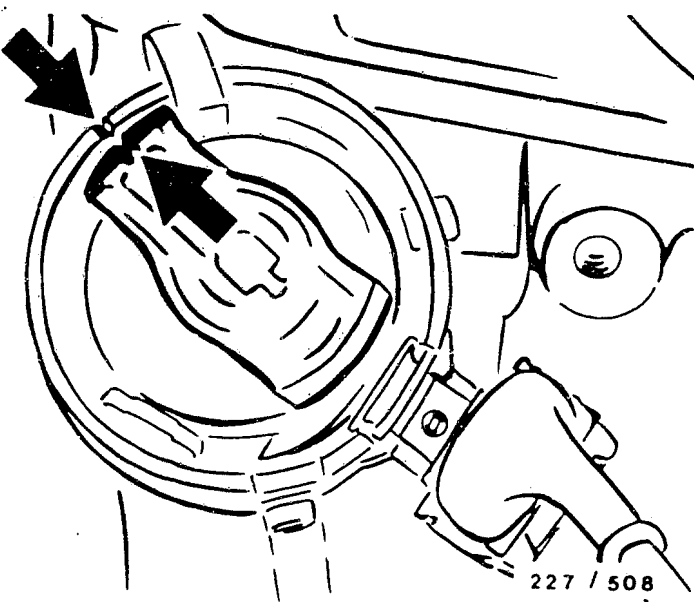


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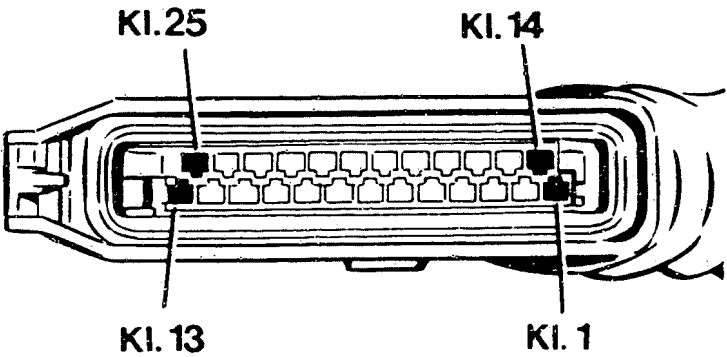
RAPID DIAGNOSIS CHART (CONTINUED)

Test step	Testing of component/function Test instructions/conditions	Termi- nals	Set values
11	CONTACT RESISTANCES (primary side) Disconnect negative and positive lead of battery. Jumper term. 30 and 87 at plug of supply relay. Resistance between battery terminal and trigger-box plug.  Resistance between battery terminal and ignition coil. Resistance between trigger-box plug and ignition coil	B+ 4 B- 2  B+ 15 1 1	max. 0.3 Ω  max. 0.3 Ω
12	PRIMARY SIGNAL  Attach trigger-box plug. Connect oscilloscope/engine-speed tester to ignition coil. Actuate starting motor.	15 1 (+) (-)	Primary voltage/ engine-speed indica- tion (magnitude irrelevant)
13	IGNITION-DISTRIBUTOR AS-INSTALLED SETTING  Engine cyl. 1 on TDC. Distributor rotor points to housing mark. See top picture.	—	—
14	PEAK-COIL-CURRENT CUTOFF  Voltage, ignition coil. Ignition ON.	15 1 (+) (-)	0 V or after approx. 1 s 0 V.
15	FAULT LAMP  Ignition ON. Engine idling. See bottom picture. (1 = Fault lamp)	3 B+	Fault lamp lights Fault lamp off or flashing

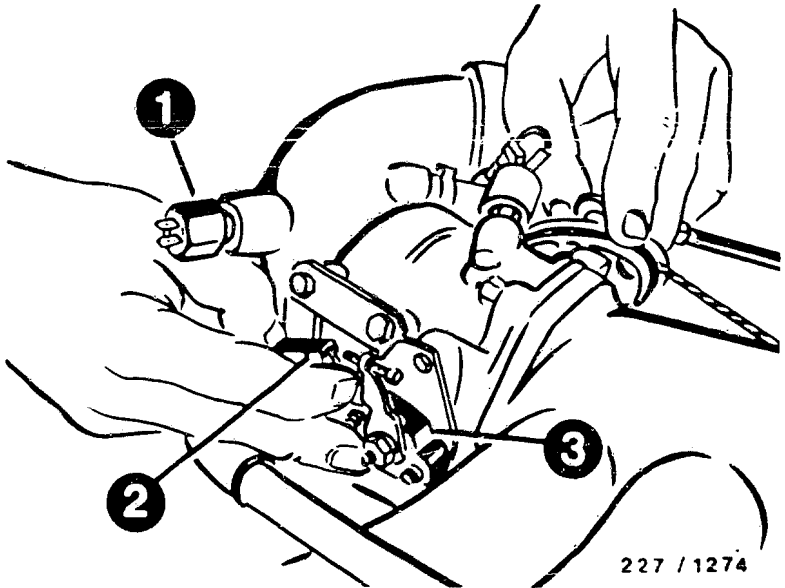


RAPID DIAGNOSIS CHART (CONTINUED)

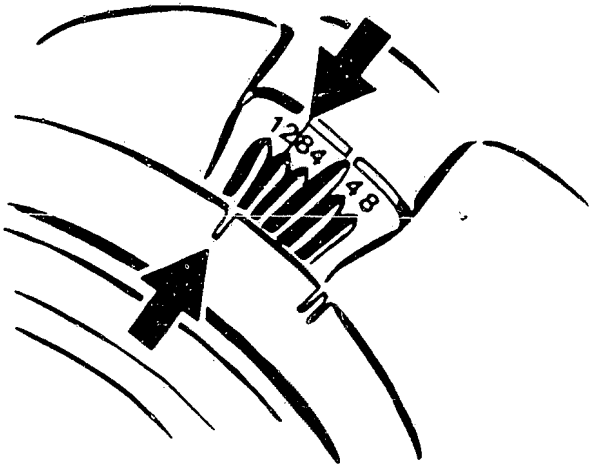
Test step	Testing of component/function Test instructions/conditions	Termi- nals	Set values
16	COOLANT TEMPERATURE SENSOR  Ignition OFF. Detach EI-K control unit plug. Resistance, EI-K control unit plug. See top picture. <div>Coolant temperature:<div>+ 20°C + 30°C + 80°C + 90°C + 100°C</div></div>	25 14	<div>2,1...2,9 k Ω 1,4...2,0 k Ω 280...370 Ω 210...280 Ω 160...210 Ω</div>
17	THROTTLE-VALVE SWITCH, IDLE CONTACT  Run warm engine at approx. 3000 min <sup>-1</sup> .  Close idle contact by hand. See center picture. (2 = idle contact)		<div>Read off ign. angle. Change in ign. angle</div>
18	BOOST-PRESSURE SWITCH  Ignition OFF. Detach EI-K control unit plug. Detach idle-contact switch. Voltage, EI-K control unit plug. Ignition ON. Apply 1.5 bar pressure to connected boost-pressure switch. (with Mityvac pump or via pressure reducer) See center picture. 1 = Boost-pressure switch 3 = Rotational-angle sensor	7 B- (+) (-)	<div>0 V  Battery voltage</div>
19	BASIC IGNITION SETTING  Engine idling (at operating temperature). Idle contact closed. Determine ignition angle. See bottom picture.		<div>10° BTDC at 900...1000 min<sup>-1</sup></div>



227 / 321



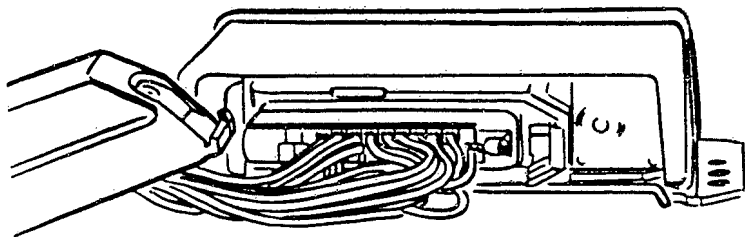
227 / 1274



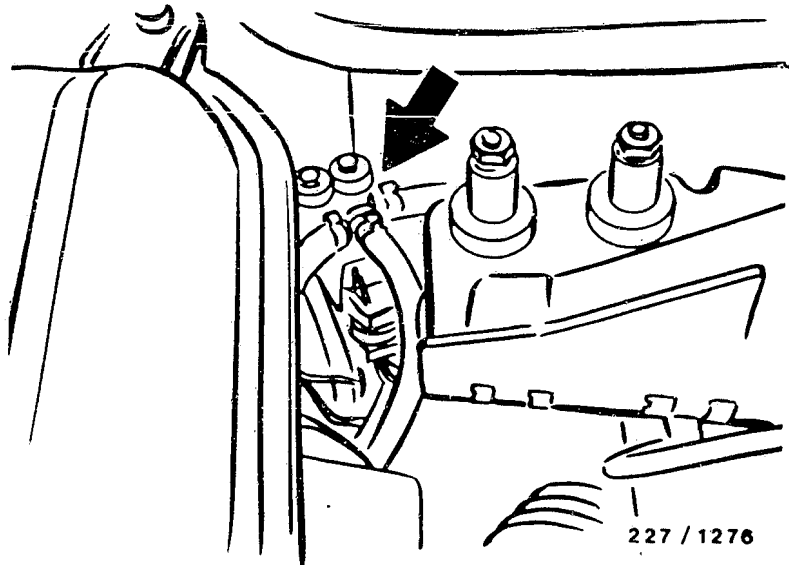
227 / 1275

RAPID DIAGNOSIS CHART (CONTINUED)

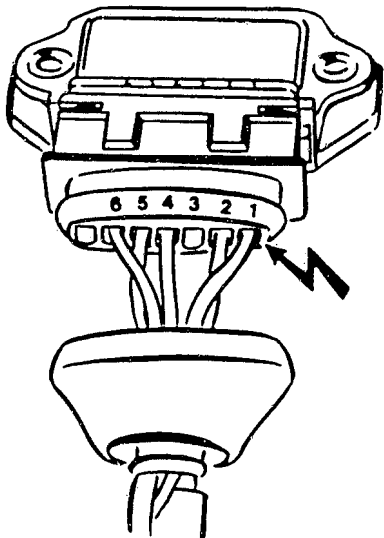
Test step	Testing of component/function Test instructions/conditions	Terminals	Set values
20	<b>FUEL ENRICHMENT</b>  Remove handle cover from EI-K control unit plug. Voltage, EI-K control unit plug. Engine idling. Jumper EI-K control unit plug with auxiliary lead. Engine speed approx. 3500 min <sup>-1</sup> . Voltage, EI-K control unit plug. See top picture.	18 B- (+) (-)  21 22  18 B- (+) (-)	  0 V to max. 1 V   approx. U <sub>B</sub>
21	<b>BOOST-PRESSURE FREQUENCY VALVE</b> (center picture, arrow)  Jumper EI-K control unit plug with auxiliary lead after removing handle cover (top picture). Run engine at 2500 min <sup>-1</sup> .	21 22	Frequency valve felt to function
22	<b>VOLTAGE, TRIGGER BOX</b>  Push back rubber sleeve at trigger-box plug. Voltage at trigger box. See bottom picture. Engine idling.	4 2 (+) (-)	12...14 V, max. 1 V below U <sub>B</sub>
23	<b>VOLTAGE, IGNITION COIL</b>  Voltage, ignition coil and battery. Engine idling.	15 B- (+) (-)	equal to/greater than 10 V
24	<b>PRIMARY VOLTAGE</b>  Connect oscilloscope with pulse-shaping circuit to ignition coil. Engine idling.	15 1 (+) (-)	295...400 V



227 / 920



227 / 1276



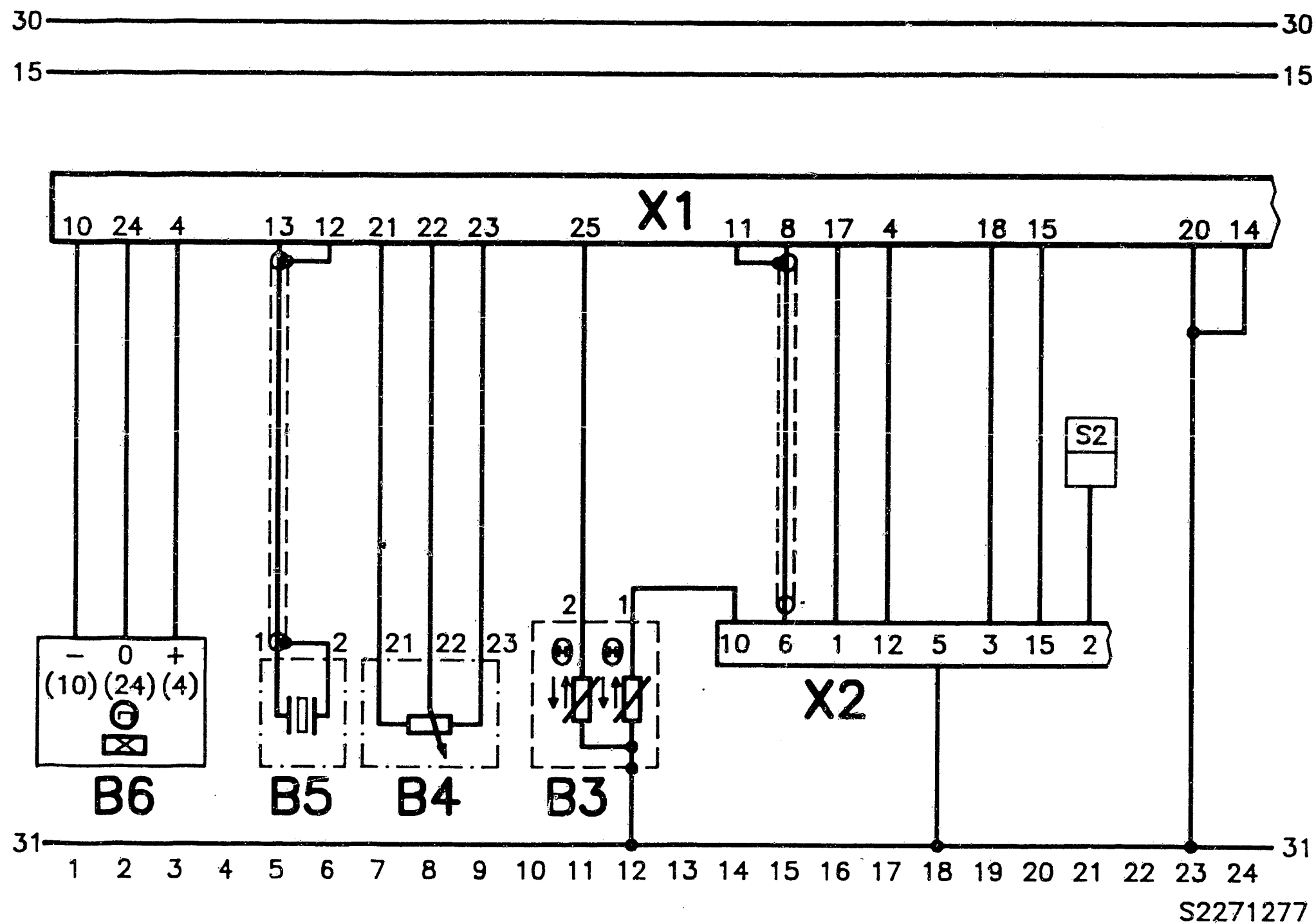
227 / 520

## TEST SPECIFICATIONS

Ignition coil, primary	0,7... 1,2 $\Omega$
secondary	6,9...11,9 k $\Omega$
Voltage, EI-K control unit with ignition ON	Battery voltage
Voltage, trigger box with ignition ON	Battery voltage
Voltage, primary circuit with ignition ON	Battery voltage
Voltage supply Magnetic pulse generator with ignition ON	equal to/greater than 10 V
Magnetic pulse generator, function at cranking speed	Rectangular pulse
Rotational-angle sensor	—
Supply voltage term. 21 and term. 23	3,5...4,5 V
Resistance term. 21 and term. 23	3,2...3,8 k $\Omega$
term. 22 and term. 23	500...810 $\Omega$
Primary signal at cranking speed	Primary voltage/ engine-speed display
Peak-coil-current cutoff with ignition ON	0 V or after approx. 1 s 0 V.
Temperature sensor (coolant)	
Resistance at coolant temperature	+ 20° C 2,1...2,9 k $\Omega$ + 30° C 1,4...2,0 k $\Omega$ + 80° C 280...370 $\Omega$ + 90° C 210...280 $\Omega$ +100° C 160...210 $\Omega$

## TEST SPECIFICATIONS (CONTINUED)

Knock sensor	
Tightening torque	15...25 Nm
Basic ignition setting at	10° BTDC 900...1000 min <sup>-1</sup>
Voltage supply, EI-K control unit with engine idling	12...14 V max. 1 V below U <sub>B</sub>
Voltage, trigger box with engine idling	12...14 V max. 1 V below U <sub>B</sub>
Voltage, ignition coil with engine idling	equal to/gr. than 10 V
Primary voltage with engine idling	295...400 V
Please refer to Autodata test specifications for settings as regards ignition, idle speed, exhaust gas and valve clearance etc.	



# ELECTRICAL TERMINAL DIAGRAM

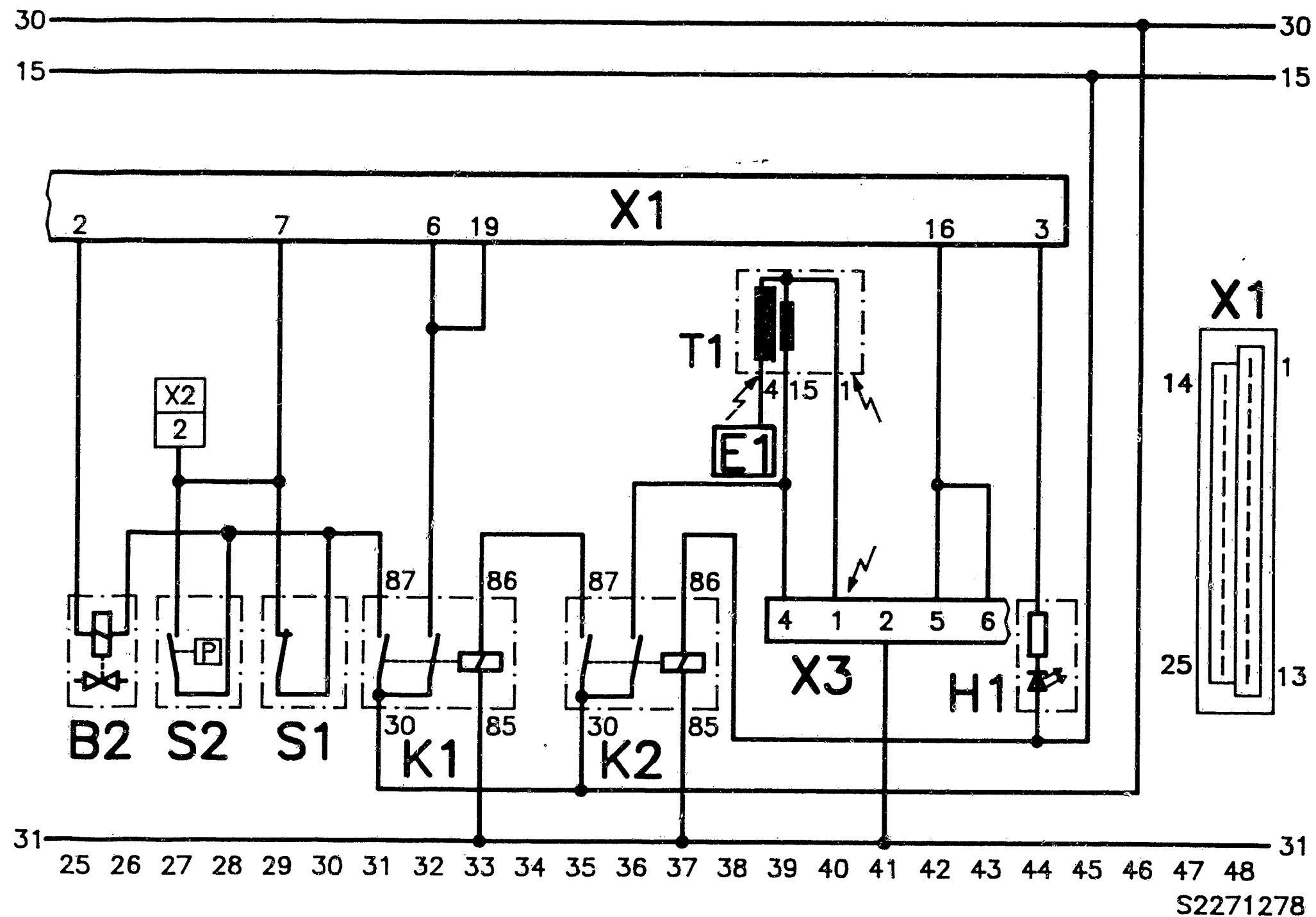
High-tension arrows = hazardous voltages 400 V - 25 KV

B3 = Coolant temperature sensor  
 B4 = Rotational-angle sensor  
 B5 = Knock sensor  
 B6 = Magnetic pulse generator

S2 = Boost-pressure switch  
 X1 = EI-K control unit plug  
 X2 = LU-Jetronic control unit plug

J23 ————— ==>

J24 ————— <==



# ELECTRICAL TERMINAL DIAGRAM (CONTINUED)

High-tension arrows = hazardous voltages 400 V - 25 KV

B2 = Frequency valve

E1 = to ignition distributor

H1 = Fault lamp

K1 = Auxiliary relay

K2 = Supply relay

S1 = Idle switch

S2 = Boost-pressure switch

T1 = Ignition coil

X1 = EI-K control unit plug

X2 = LU-Jetronic control unit plug

X3 = Trigger-box plug

## INSTALLATION POSITION OF COMPONENTS

### Trigger box:

The trigger box and ignition coil are installed in the engine compartment - on left in direction of travel - and attached to inner fender.

### Relay combination:

The supply relay and auxiliary relay are located above the fuse box in the engine compartment.

### EI-K control unit:

The EI-K control unit is fitted beneath the footrest in the passenger's footwell.

### Fault lamp:

The fault lamp and the corresponding resistor are located in the instrument panel.

### Knock sensor:

The knock sensor is located at the engine block next to the oil filter; on left in direction of travel.

### Boost-pressure switch:

The boost-pressure switch is screwed into the intake manifold.

### Frequency valve:

The frequency valve is located in the engine compartment - on the right in the direction of travel - above the air-flow sensor.

### LU-Jetronic control unit:

The LU-Jetronic control unit is located in the passenger compartment on the passenger's side behind the glove compartment.

Please refer to basic instructions for further details and illustrations.

For production reasons:  
continued on the following  
coordinate.

Trouble-shooting instructions : POR-5011  
 BOSCH system : EZ-K  
 Make of vehicle : PORSCHE  
 Basic microcard : PKW-072

# TABLE OF CONTENTS

Section	Coordinate
Special features, usage, safety	02
Trouble-shooting chart	07
Self-diagnosis test table	09
Rapid diagnosis chart	15
Test specifications	21
Electrical terminal diagram	25
Installation position of components, notes on removal and installation	27

## SPECIAL FEATURES

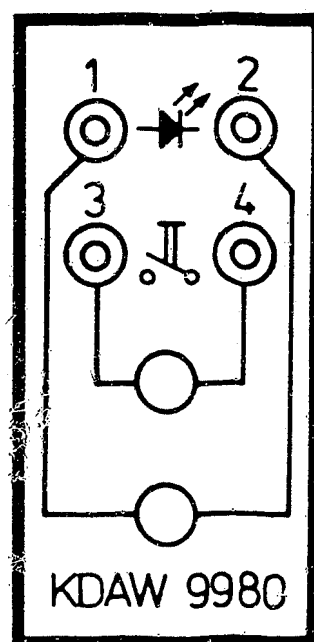
These brief instructions, valid at the time of publication, apply to the following Porsche model:

928 S 4 with 5.0 l/ 8-cyl. engine 8.88 ->  
 Engine type M 28/41 (manual transmission)  
 M 28/42 (automatic)

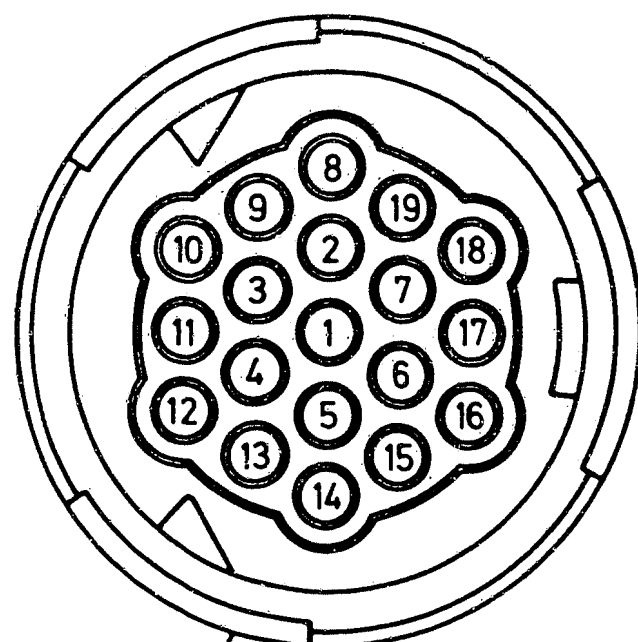
- \* EI-K control unit 0 227 400 154
  - \* Trigger box 0 227 100 124  
(with current limitation)
  - \* Ignition coil 0 221 118 322
  - \* Modified map encoding
  - \* As of approx. 11.88 no TDC sensor in vehicle
  - \* Self-diagnosis is effected by way of 19-pole diagnosis socket in vehicle. As a result, there is no 12-pole self-diagnosis plug connection on the control-unit holding plate.
  - \* The fault memory can be read out using the Pocket System Tester KTS 300 (0 684 400 300) with the program module PPG 204 as of status 01.09.1989.
- Note:  
 Further diagnosis possibilities (actuator diagnosis etc), which would be feasible with newer program-module statuses, are not evaluated with these vehicles.
- Pay attention to operating instructions for KTS 300. Connection of the KTS 300 to the diagnosis socket in the vehicle is via the adapter lead 1 684 465 192 (PORSCHE).
- \* As an alternative to the KTS 300, the self-diagnosis can be read out by way of a flashing code (not possible with all control units).

- \* The significance of the second position of the 4-digit flashing code has been altered. If the number 1 is indicated as the 2nd digit, this means that the fault is currently present. If the number 2 is indicated as the 2nd digit, this means that a fault has been present, but that this is not currently the case (e.g. loose contact).





1



2

227/1252

1 = Evaluation unit KDAW 9980

2 = Diagnosis socket

#### TERMINAL ASSIGNMENT:

7 = L-lead (activation/stimulation lead)

8 = K-lead

10 = Ground

13 = Term. 15

15 = Lamp lead

#### SPECIAL FEATURES (CONTINUED)

Connect up evaluation unit KDAW 9980 or activate flashing code:

Diagnosis socket term. 13 to KDAW 9980 socket 1.

Diagnosis socket term. 15 to KDAW 9980 socket 2.

Diagnosis socket term. 7 to KDAW 9980 socket 3.

Diagnosis socket term. 10 to KDAW 9980 socket 4.

Ignition ON. Evaluation-unit lamp must light up.

Activate self-diagnosis by way of button KDAW 9980 as described below:

#### SPECIAL FEATURES (CONTINUED)

Keep button depressed (approx. 2 seconds) until lamp goes out. Release button immediately.

LH-Jetronic control unit is ready for self-diagnosis output. Note down fault code (fault code is repeated). The fault memory is read out step by step by pressing the button following each fault code (approx. 2 seconds) until the lamp goes out. Release button immediately. Fault memory has been read out when fault code "1" (end of fault output) appears.

Fault elimination in accordance with SIS LH-Jetronic. Keep button pressed for subsequent activation.

Lamp goes out after approx. 2 seconds.

Lamp comes on again after approx. 0.5 seconds and then goes out after a further 3.5 seconds.

Release button immediately.

EI-K control unit is ready for output of self-diagnosis. Note down fault code (fault code is repeated).

The fault memory is read out step by step by pressing the button after every fault code (approx. 2 seconds) until the lamp goes out. Release button immediately.

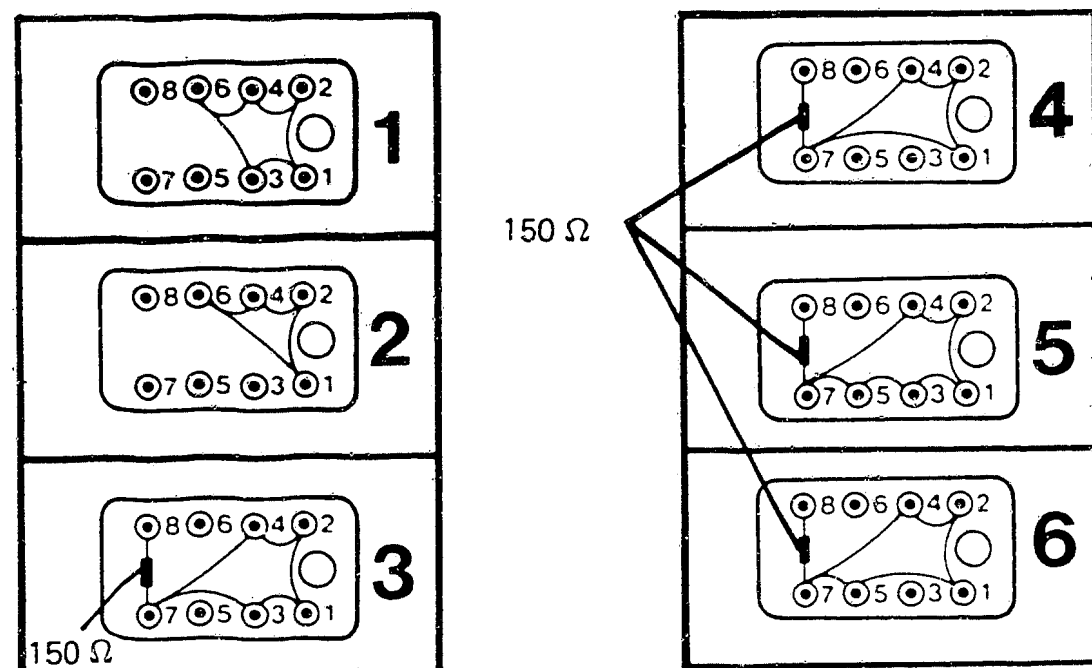
Fault memory has been read out when fault code "2" (end of fault output) appears.

A new diagnosis run can be effected by switching the ignition off and on again before activating the self-diagnosis via the button.

FAULT MEMORY IS CLEARED if, with fault code "2" (end of fault output), the button is pressed (approx. 10 seconds) until the lamp goes out for a third time (see following lamp cycle). Release button.

#### LAMP CYCLE:

Lamp goes O U T after approx. 2 seconds, comes on after approx. 0.5 seconds and goes O U T after 3.5 seconds. Then on after a further approx. 0.5 seconds and O F F again after 3.5 seconds.



Encoding plugs (circuit diagrams 1..6)

## SPECIAL FEATURES (CONTINUED)

Circuit diagram (encoding plug)	Version
1	= ECE, manual transmission without catalytic converter
2	= ECE, automatic without catalytic converter
3	= Worldwide, manual transmission with catalytic converter
4	= Worldwide, automatic with catalytic converter
5	= Fuel grade, 91 RON, unleaded, manual transmission
6	= Fuel grade, 91 RON, unleaded, automatic

## STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults. For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

## SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

CAUTION!  
High-performance ignition system with dangerous primary and secondary voltages!  
Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

## TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Rough idling (engine speed, exhaust gas).
4. Poor throttle response, flat spot during acceleration.
5. Engine misfiring (ignition, fuel injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

Cause (component fault)										
*	*	*	*	*	*	*	*	*	*	Self diagnosis
*			*							High-voltage side
*										Firing sequence
*			*							Ignition coil
*										Voltage, trigger boxes
*										Voltage, primary circuits
*										Voltage, EI-K control unit
*										Insulation, engine-speed and reference-mark sensors
*										Internal resistance, engine-speed and reference-mark sensors

## TROUBLE-SHOOTING CHART (Continued)

Customer complaint (symptoms of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Rough idling (engine speed, exhaust gas).
4. Poor throttle response, flat spot during acceleration.
5. Engine misfiring (ignition, fuel injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

Cause (component fault)										
*										Voltage, engine-speed and reference-mark sensors
*										Trigger boxes - activation
*										Contact resistances (primary side)
			*							Voltage, trigger box (engine idle)
			*							Voltage, ignition coil (engine idle)
			*							Primary voltage

## SELF-DIAGNOSIS TEST TABLE

Pocket system tester Fault indication	Fault code	Flash- ing code	Test instructions / Test conditions	Termi- nals	Set values
		2	END OF FAULT OUTPUT	—	—
		25	NO FAULT STORED	—	—
Idle switch Short to ground Open circuit	12	2112/ 2212	Detach LH-Jetronic control unit plug. Resistance, EI-K control unit plug. Throttle valve in idle position. Open throttle valve approx. 1°	8 18	Approx. 0 $\Omega$ (cont.) Infinity $\Omega$ (open- circuit)
Full-load switch Short to ground	13	2113/ 2213	Detach LH-Jetronic control unit plug. Resistance, EI-K control unit plug. Fully depress accelerator pedal. Release accelerator pedal (idle position).	18 26	Approx. 0 $\Omega$ (cont.) Infinity $\Omega$ (open- circuit)
Engine temp. sensor Short to ground Op.circ./sh. to B+	14	2114/ 2214	Resistance, EI-K control unit plug	18 19	+ 20° C = 2.1–2.9 k $\Omega$ + 30° C = 1.4–2.0 k $\Omega$ + 80° C = 280–370 $\Omega$ + 90° C = 210–280 $\Omega$ +100° C = 160–210 $\Omega$
Idle-speed/full- load switch Comparison not O.K.	15	2115/ 2215	Detach LH-Jetronic control unit plug. Resistance, EI-K control unit plug. Throttle valve in idle position. Open throttle valve approx. 1°.  Resistance, EI-K control unit plug. Fully depress accelerator pedal. Release accelerator pedal (idle position).	8 18  18 26	Approx. 0 $\Omega$ (cont.) Infinity $\Omega$ (open- circuit)  Approx. 0 $\Omega$ (cont.) Infinity $\Omega$ (open- circ)
Load signal incorrect/no signal	21	2121/ 2221	Resistance, EI-K and LH-Jetronic control unit plug. Attach LH-Jetronic control unit plug. Voltage, EI-K control unit plug with handle cover removed. Engine idling. Note: ANALOG VOLTMETER (small measuring range). Briefly depress accelerator pedal as far as it will go (burst of acceleration). Observe voltmeter.	9 25  9 18 (+)(-)	Approx. 0 $\Omega$ (cont.)  0.1–1V  Slight increase in voltage

## SELF-DIAGNOSIS TEST TABLE (CONTINUED)

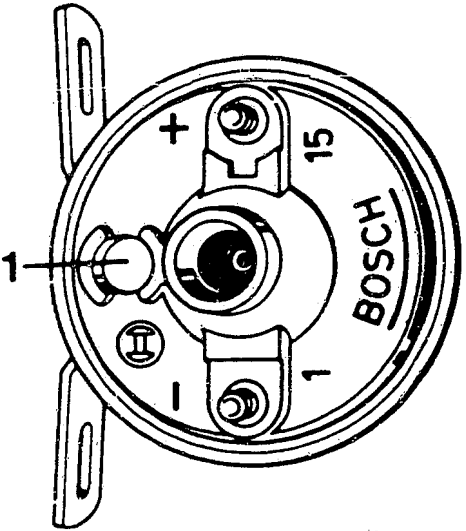
Pocket system tester Fault indication	Fault code	Flash- ing code	Test instructions / Test conditions	Termi- nals	Set values
Transmission overload protection Short to ground	26	2126/ 2226	Unscrew union nut at transmission overload protection switch. Remove clutch. Resistance, transmission overload protection switch. Engine idling. Apply hand brake. Observe safety precautions (e.g. chocks at rear wheels). Transmission selector lever in driving position "N" or "P" Transmission selector lever in driving position "D"  Voltage at coupling, transmission overload protection switch. Ignition ON.	— — —	Greater than 20 k $\Omega$ (open-circuit) Less than 1 $\Omega$ (con- tinuity)  Approx. 10 V
Knock sensor 1  Incorrect/no signal	31	2131/ 2231	Visual inspection, knock-sensor plug connection (oxidation). Resistance, knock-sensor plug connection and EI-K control unit plug.  Resistance, EI-K control unit plug.  Tightening torque (time required for work approx. 6 hours).	1 20 2 2 3 2 18 20 —	Approx. 0 $\Omega$ Approx. 0 $\Omega$ Approx. 0 $\Omega$ Infinity $\Omega$ (open- circuit) 15-25 Nm
Knock sensor 2  Incorrect/no signal	32	2132/ 2232	Visual inspection, knock-sensor plug connection (oxidation). Resistance, knock-sensor plug connection and EI-K control unit plug.  Resistance, EI-K control unit plug.  Tightening torque (time required for work approx. 6 hours).	1 21 2 3 3 3 18 21 —	Approx. 0 $\Omega$ Approx. 0 $\Omega$ Approx. 0 $\Omega$ Infinity $\Omega$ (open- circuit) 15-25 Nm
Control unit  Defective	33	2133/ 2233	EI-K control unit defective.	—	—
Cylinder ident- ification Short to ground  Open circuit	34	2134/ 2234	Rectangular pulse, EI-K control unit plug with handle cover removed.  Start engine.	22 B- (+) (-)	Rectangular pulse

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

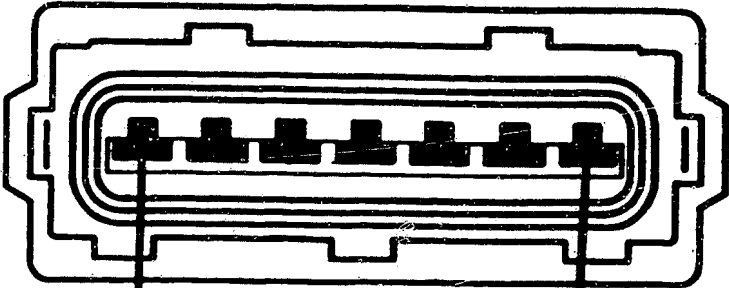
Pocket system tester Fault indication	Fault code	Flash- ing code	Test instructions / Test conditions	Termi- nals	Set values
Control unit Digital sec. (comput) defective	41	2141/ 2241	EI-K control unit defective.	—	—

RAPID DIAGNOSIS CHART

Test step	Testing of component/function Test instructions/conditions	Termi- nals	Set values
1	HIGH-VOLTAGE SIDE Test for proper functioning of, for example, spark plugs, ignition harness, distributor cap etc. (e.g. open circuit, shunt). Assessment, for example, by means of ignition oscillogram, resistance measurement, visual examination.	—	—
2	IGNITION COIL Following test must be conducted on both ignition coils.  Visual examination: plug present, sealing compound escaped? See upper illustration. Resistance, primary Resistance, secondary	   1 15 1 4	   0.4-0.7 Ω 4.9-8.7 k Ω
3	VOLTAGE, TRIGGER BOXES Following test must be conducted on both trigger-box plugs.  Disconnect trigger-box plug. Ignition ON. Voltage, trigger-box plug. See lower illustration.	   4 2 (+) (-)	   Battery voltage
4	VOLTAGE, PRIMARY CIRCUITS Following test must be conducted on both trigger-box plugs.  Disconnect trigger-box plug. Ignition ON. Voltage, trigger-box plug. See lower illustration.	   1 2 (+) (-)	   Battery voltage



227/0059



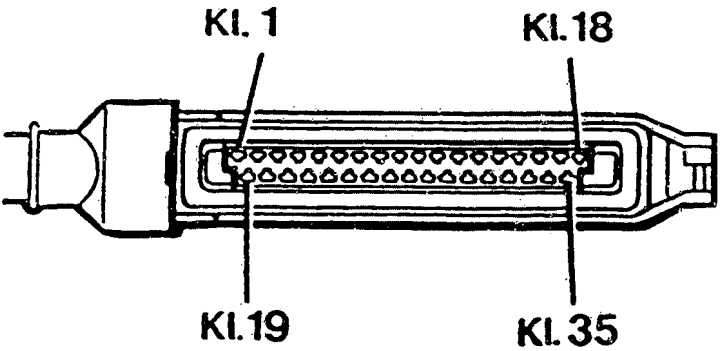
KI.1

KI.7

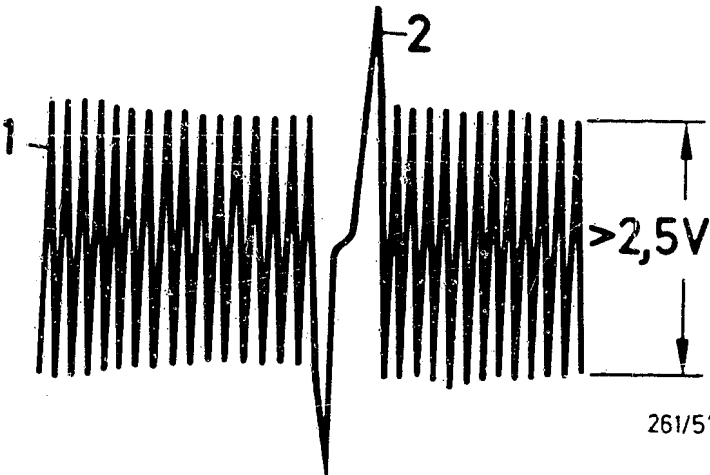
227/320/1

RAPID DIAGNOSIS CHART (Continued)

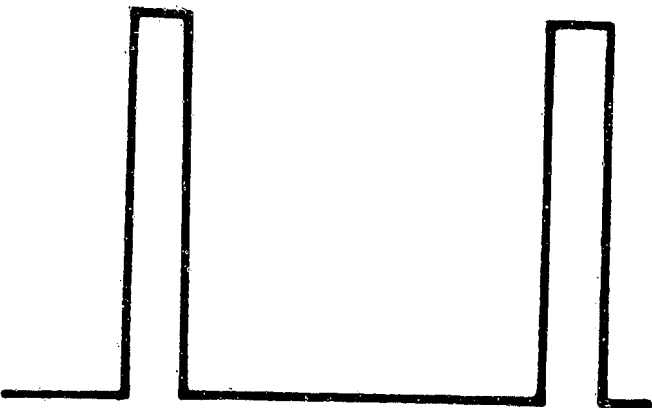
Test step	Testing of component/function Test instructions/conditions	Termi- nals	Set values
5	VOLTAGE, EI-K CONTROL UNIT Disconnect EI-K control-unit plug. Ignition ON. Voltage, EI-K control-unit plug. See upper illustration.	29 18 (+) (-)	Battery voltage
6	INSULATION, ENGINE-SPEED AND REFERENCE-MARK SENSORS Disconnect EI-K control-unit plug. Resistance, EI-K control-unit plug. See upper illustration.	23 24	infinity $\Omega$
7	INTERNAL RESISTANCE, ENGINE-SPEED AND REFERENCE-MARK SENSORS Disconnect EI-K control-unit plug. Resistance, EI-K control-unit plug. See upper illustration.	6 23	0.6-1.6 k $\Omega$
8	VOLTAGE, ENGINE-SPEED AND REFERENCE-MARK SENSORS Disconnect EI-K control-unit plug. Oscilloscope "Special" to EI-K control-unit plug. See upper illustration. Start engine.	23 6 (+) (-)	Engine-speed signal equal to / greater than 2.5 V (center illus.)
9	TRIGGER-BOX ACTIVATION Following test must be conducted on both trigger-box plugs.  Disconnect trigger-box plug. Oscilloscope "Special" to trigger-box plug.  Start engine.	5 2 (+) (-)	Rectangular pulse (lower illustration)



227/925



261/578

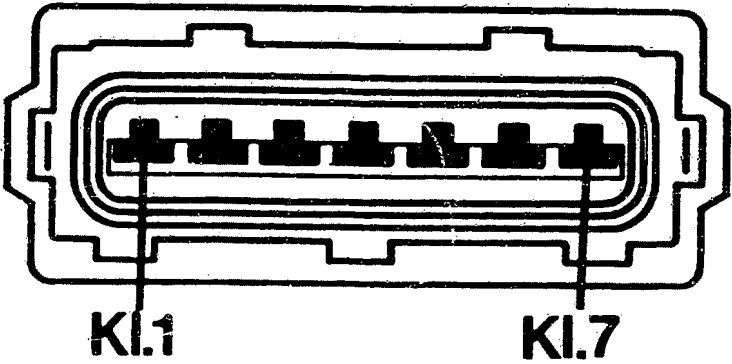


227/1114



RAPID DIAGNOSIS CHART (Continued)

Test step	Testing of component/function Test instructions/conditions	Termi- nals	Set values
10	<p>CONTACT RESISTANCES (Primary side)</p> <p>Following test must be conducted on both trigger-box plugs. See illustration.</p> <p>Disconnect neg. and pos. cables from battery. Ignition ON. Resistance of battery terminal to trigger-box plug.</p> <p>Resistance of battery terminal to ign. coil. Resistance of trigger-box plug to ign. coil.</p>	<p>B+ 4 B- 2</p> <p>B+ 15 1 1</p>	<p>Max. 0.3 <math>\Omega</math></p> <p>Max. 0.3 <math>\Omega</math></p>
11	<p>VOLTAGE, TRIGGER BOX</p> <p>Following test must be conducted on both trigger-box plugs.</p> <p>Push back rubber sleeve of trigger-box plug. Voltage, trigger-box plug. Engine at idle.</p>	<p>4 2 (+) (-)</p>	<p>12-14 V Max. 2 V below U<sub>B</sub></p>
12	<p>VOLTAGE, IGNITION COIL</p> <p>Voltage, ignition coil and battery. Engine at idle.</p>	<p>15 B- (+) (-)</p>	<p>Equal to/greater than 10 V</p>
13	<p>PRIMARY VOLTAGE</p> <p>Oscilloscope with pulse shaper at ign. coil. Engine at idle.</p>	<p>15 1 (+) (-)</p>	<p>295-365 V</p>



227/320/1

# TEST SPECIFICATIONS

Idle throttle-valve switch	
Throttle-valve idle position	Approx. 0 $\Omega$
Open throttle valve 1°	Infinity $\Omega$
Full-load throttle-valve switch	
Depress accelerator pedal fully to floor	Approx. 0 $\Omega$
Accelerator-pedal idle position	Infinity $\Omega$
Coolant-temperature sensor	+20°C=2.1-2.9 k $\Omega$
	+30°C=1.4-2.0 k $\Omega$
	+80°C=280-370 $\Omega$
	+90°C=210-280 $\Omega$
	+100°C=160-210 $\Omega$
Load signal	
Engine at idle	0.1-1 V
Apply full throttle briefly	Voltage increases slightly

# TEST SPECIFICATIONS (Continued)

Transmission overload protection	
Driving position " N " / " P " " D " with engine at idle	greater than 20 k $\Omega$ less than 1 $\Omega$
Knock sensor, tightening torque	15-25 Nm
Hall-generator cylinder detection at cranking speed	Rectangular pulse
Ignition coil, primary	0.4-0.7 $\Omega$
Ignition coil, secondary	4.9-8.7 k $\Omega$
Voltage, trigger box with ignition ON	Battery voltage
Voltage, primary circuits with ignition ON	Battery voltage
Voltage, EI-K control-unit plug with ignition ON	Battery voltage

# TEST SPECIFICATIONS (Continued)

## Engine-speed and reference-mark sensors

Insulation	Infinity $\Omega$
Internal resistance	0.6...1.6 k $\Omega$
Voltage at cranking speed	At least 2.5 V

Trigger-box activation	Rectangular pulse
---------------------------	-------------------

## Contact resistances

Supply leads, trigger box	Max. 0.3 $\Omega$
------------------------------	-------------------

Supply leads, ignition coil	Max. 0.3 $\Omega$
--------------------------------	-------------------

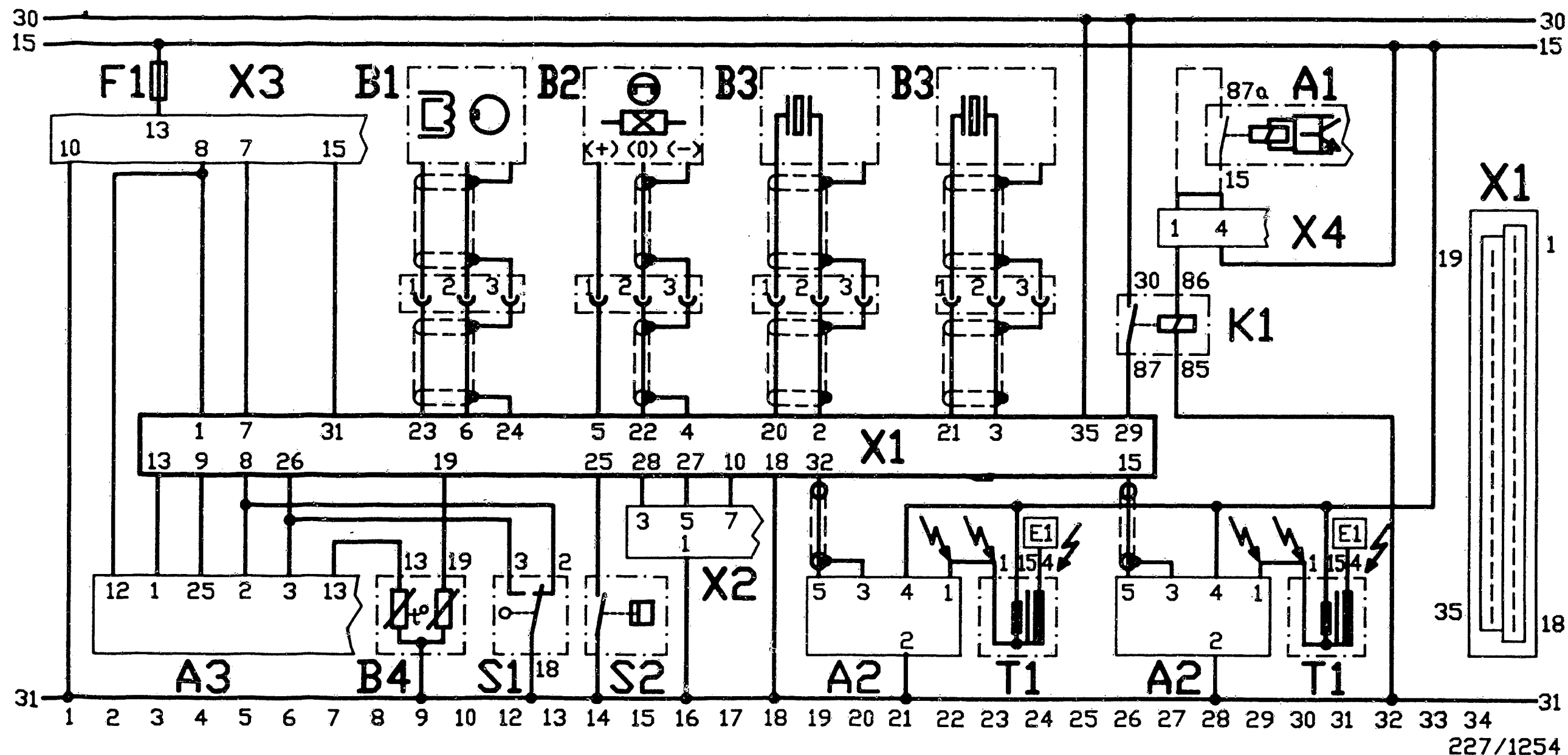
Voltage, trigger box Engine at idle	12...14 V Max. 2 V below $U_B$
--	-----------------------------------

Voltage, ignition coil Engine at idle	Equal to/greater than 10 V
--	-------------------------------

Primary voltage Engine at idle	295...365 V
-----------------------------------	-------------

See SIS microcard LH-Jetronic and test specifications given in Autodata for settings for idle speed, exhaust gas etc.

For production reasons:  
continued on the following  
coordinate.



High-tension arrows: caution 400 V...25 kV

A1 = Alarm control unit  
 A2 = Trigger box  
 A3 = LH-Jetronic control unit  
 B1 = Pulse generator  
 B2 = Hall-trigger cylinder recognition  
 B3 = Knock sensor  
 B4 = Temperature sensor (coolant)  
 E1 = to high-tension distributor  
 F1 = Fuse

K1 = EI-K supply relay  
 S1 = Throttle-valve switch  
      idle/full load  
 S2 = Transmission overload  
      protection switch  
 T1 = Ignition coil  
 X1 = EI-K control unit plug  
 X2 = Encoding plug  
 X3 = Diagnosis socket  
 X4 = Plug connection, car alarm

ELECTRICAL TERMINAL DIAGRAM

K25 —————>

K26 —————<

## INSTALLATION POSITION OF COMPONENTS

Ei-K control unit and LH-Jetronic control unit are located in the footwell on the passenger's side on the right.

Diagnosis connection is located on the control-unit mounting plate.

Trigger boxes are located on the cover-lock transverse wall on the left-hand side.

Coolant-temperature sensor is located behind the oil filler cap.

Knock sensors are located on the upper part of the crankcase.

Hall-generator cylinder detection is located behind the camshaft gear of the row of cylinders 1 - 4 (on the right as seen in the forward direction of travel).

Engine-speed and reference-mark sensor is located at the rear of the engine block beneath the air filter.

Throttle-valve switch is located on the throttle-valve assembly beneath the intake distributor and intake manifold.

Ignition supply relay is located in the central electrics (on passenger's side in the footwell beneath the floor board).

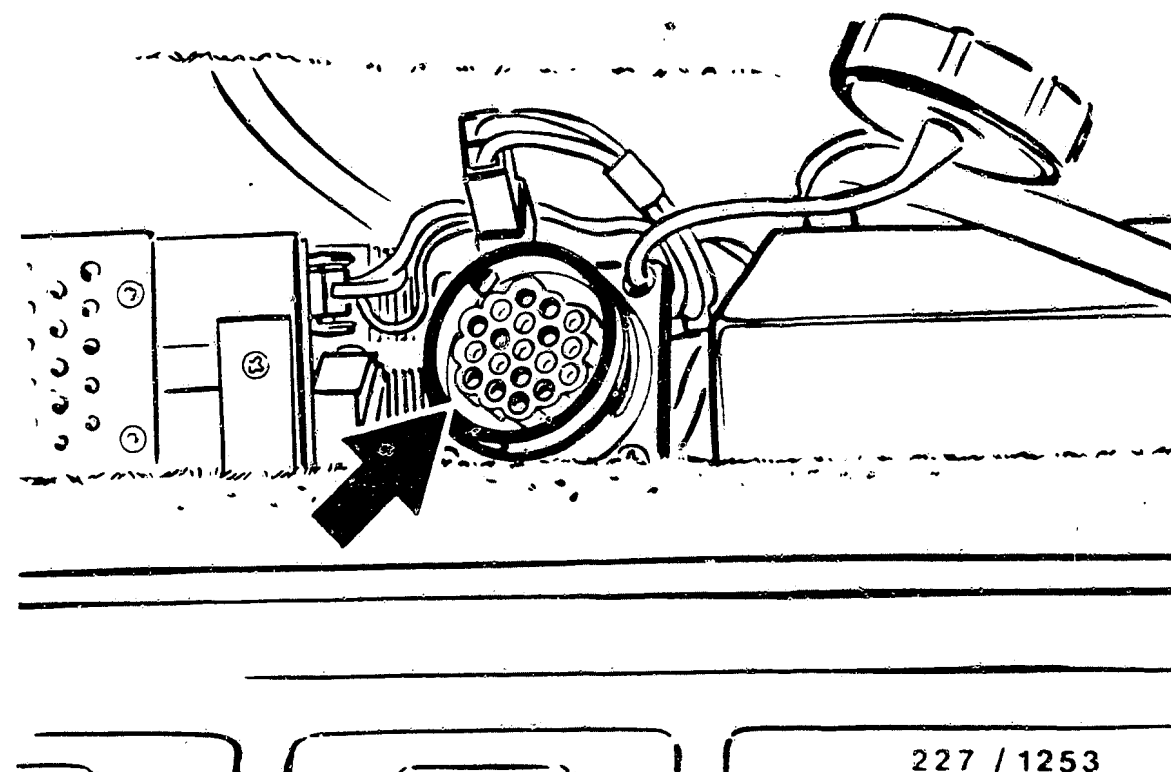
Transmission overload-protection switch is located on the left-hand side of the transmission.

Test connection for adapter lead (TDC sensor) is located on the left-hand side of the engine (in front of the air filter).

Trigger-box ground is located above the right-hand ignition coil.

Engine ground is located between the engine and bodywork.

Electronics ground is located beneath the fuel-pressure regulator and fuel-pressure damper.



Arrow = Diagnosis socket

## INSTALLATION POSITION OF COMPONENTS (CONTINUED)

The diagnosis socket is located beneath the booster cover (next to passenger's seat). See picture, arrow.

Trouble-shooting instructions: POR-5012

BOSCH system : Motronic ML 3.1

Make of vehicle : PORSCHE

Basic microcard : POR-507

## TABLE OF CONTENTS

<u>Section</u>	<u>Coordinates</u>
Special features.....	02
Structure, usage.....	06
Safety and precautionary measures.....	06
Rapid diagnosis chart for universal test adapter....	07
Test specifications.....	21
Electrical terminal diagram.....	23
Installation position of components, removal and installation instructions.....	27

## SPECIAL FEATURES

These trouble-shooting instructions, valid at the time of publication, apply to the following vehicle models:

PORSCHE 924 S (2.5l), 9.87 → 8.88 (end of series)

PORSCHE 944 (2.5l), 9.87 → 8.88

PORSCHE 944 (2.7l), 9.88 →

\* Countries: Worldwide.

\* Motronic system ML 3.1 (35-pole plug).

\* The instructions apply to the following control units:

0 261 200 086 for worldwide use between 9.87 and 8.88.

0 261 200 089 for worldwide use in model 944 as of 9.88 (model year 89).

\* The 2.5 l engine is designed for 95 RON (91 RON for Australia). Compression 10.2, power output 118 kW (Belgium 116 kW).

\* Production of the Model 924 and the 2.5 l engine was terminated as of model year 89 (9.88 →).

\* As of model year 89 the Model 944 features a 2.7 l engine with control unit 0 260 200 089. Power output 121 kW, compression 10.9, min. 95 RON.

At the same time, the system pressure was increased to 3.5 bar to improve hot starting. The pressure regulator, fuel-line-pressure damper, fuel pump and injection valves have been adjusted to the higher pressure.

\* All vehicles are equipped as standard with a catalytic converter. Vehicles without catalytic converter are also available depending on the regulations in the countries concerned. In the case of vehicles without a catalytic converter, there is no active-carbon container in the tank ventilation system.

## SPECIAL FEATURES (2)

- \* Idle-mixture control with two-winding rotary actuator.
- \* Altitude correction for USA and Japan.
- \* Variant encoding  
for control units 0261 200 086 and ...089:

Term. 10 and term. 30 are connected differently in the wiring harness, so as to be able to cover all country variants and vehicles with/without catalytic converter using standard control units.

Terminals Country variant	Term.10	Term. 30
ROW 3) 4) 5) without cat.	open	1.8 k $\Omega$ to ground 2)
ROW with cat. 4) 6)	open	open
USA Fed. with cat. 6)	open	Altitude capsule
USA California Japan with cat. 6)	to ground 1)	Altitude capsule

- 1) Use encoding plug (Porsche No. 944.612.525.01)
- 2) Use adapter plug with 1.8 k  $\Omega$  (Porsche No. 944.612.421.00).
- 3) In the case of vehicles with no lambda sensor, connect a cable jumper (Porsche No. 911.612.422.00) to wiring-harness plug instead of lambda sensor, so as to avoid interference.
- 4) ROW = Rest of World (not including USA).  
Cat. = Catalytic converter
- 5) Premium fuel, unleaded or leaded, min. 95 RON.
- 6) Premium fuel, unleaded, min. 95 RON.  
If necessary (not in USA) regular fuel, unleaded (min. 91 RON) permitted; for this purpose, attach adapter plug (see 2.).

## SPECIAL FEATURES (3)

- \* Reference-mark sensor is shielded with metal sleeve in holder, so as to avoid interference. Interference can result in an incorrect ignition angle and make it impossible to start the engine. The metal sleeve is an absolute necessity for vehicles with a bell housing featuring a recess for the reference-mark sensor instead of a hole.
- \* The vehicle can be fitted at the factory with a car alarm. If no car alarm is installed, there is a jumper between the driving switch term. 15 and the Motronic relay term. 86 in the central-electrics console.

## SPECIAL FEATURES

\*New fuel hoses (with the exception of intake end) made of polyamide tubing with rubber sheathing. The tubes can be recognized from the non-pressed or missing sleeves at the connecting pieces.

### After-sales-service information:

Do not kink or pinch off polyamide tubing (e.g. using spring clip), so as to avoid damage and leakage. Replacement or fitting of connecting piece is not possible. The entire hose must be replaced together with the connecting pieces.

### Perform pressure-holding test as follows:

Build up fuel pressure (briefly jumper at Motronic relay term. 87 and 30).

Max. pressure drop 0.5 bar in 30 minutes with engine warm. Continue trouble-shooting if residual pressure drops off more quickly.

Build up pressure again for a brief period.

Remove return line at pressure regulator, hold vessel beneath it. If fuel emerges, pressure regulator is defective. If no fuel emerges, continue test.

Connect return line, pinch off intake line and repeat leak test. Test injection valves in the event of drop in pressure.

Check valve in pump is defective if there is no drop in pressure.

## STRUCTURE, USAGE

These brief instructions essentially comprise vehicle-specific special features and test specifications (set values).

Trouble-shooting is described in detail in the trouble-shooting chart in the basic instructions.

NOTE: Even if reference is made to basic instructions, the set values, term. assignments and special features in these veh.-spec. brief instruct. are always binding.

## SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

### CAUTION!

High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

Avoid fuel injection and high-tension flashover when testing compression! Motronic relay is therefore to be disconnected.



# RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.1

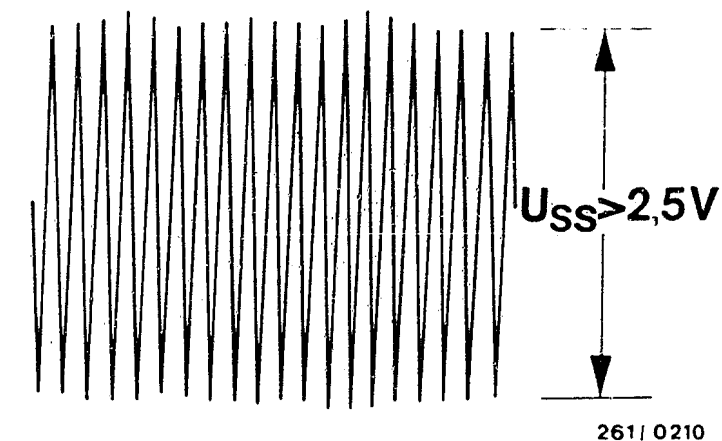
Adapter lead: With no catalytic converter 1 684 463 124 / with catalytic converter 1 684 463 128

Note: Lead...124 can be used as a substitute on catalytic-converter models, however the lambda closed-loop-control function test is to be additionally performed (without universal adapter).

Test step	Switch setting V	Ω	Measurement	Measurement at control-unit plug between term.	Remarks	Test specifications (indication)
1	 V	1	Insulation resistance of engine-speed sensor.	8 and 5	Neutral gear. Ignition off. Detach control unit and pump fuse no. 2.	Greater than 1 M Ω
2	 V	2	Insulation resistance of reference-mark sensor.	25 and 5	—	Greater than 1 M Ω
3	 V	3	Winding resistance of engine-speed sensor.	8 and 27	—	0,6...1,6 k Ω
4	 V	4	Winding resistance of reference-mark sensor.	25 and 26	—	0,6...1,6 k Ω
5	 V	5	Resistance of engine temperature sensor (NTC II).	13 and 5	Resistance dependent on temperature: (+ 15° C...+ 30° C) : (+ 80° C) :	1,45...3,3 k Ω 280...360 Ω
6	 V	6	Resistance of air temperature sensor (NTC I).	22 and 5	Resistance dependent on temperature: (+ 15° C...+ 30° C) : (+ 80° C) :	1,45...3,3 k Ω 280...360 Ω
7	 V	7	Resistance of map switch	10 and 5	For USA California and Japan: For USA Federal and general:	Less than 10 Ω Greater than 1 M Ω
8	 V	8	Not applicable	—	—	—
9	 V	9	Throttle-valve switch: Resistance of idle contact.	2 and 5	Accelerator not depressed :  Open throttle valve somewhat:	Less than 10 Ω Greater than 1 M Ω
10	 V	10	Throttle-valve switch: Resistance of full-load contact.	3 and 5	Fully depress accelerator pedal:	Less than 10 Ω

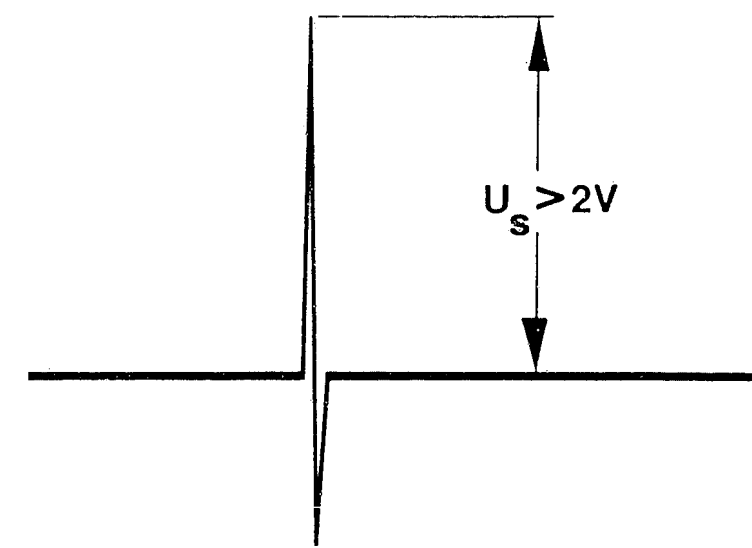
# RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER (CONTINUED)

Test step	Switch position V	Ω	Measurement and remarks	Measurement at control-unit plug between terms.	Test specifications (reading)
11	V	11	Resistance of ground lead	16 and 5	less than 10 Ω
12	V	12	Resistance of ground lead	17 and 5	less than 10 Ω
13	V	13	Resistance of ground lead	19 and 5	less than 10 Ω
14	V	14	Resistance at input for altitude correction. Vehicles without lambda closed-loop control: Vehicles with lambda closed-loop control: Vehicles with altitude sensor, switch open (below 1000 m): Vehicles with altitude sensor, switch closed (above 1000 m):	30 and 5	1,6...2 k Ω greater than 1 M Ω greater than 1 M Ω less than 10 Ω
15	V	15	Resistance of driving-position selector switch.	28 and 5	less than 10 Ω
16	1	15	Engine-speed-sensor signal using oscilloscope. Disengage gear and start.	8 and 27	See upper illustration
17	2	15	Reference-mark-sensor signal using oscilloscope. Disengage gear and start.	25 and 26	See lower illustration



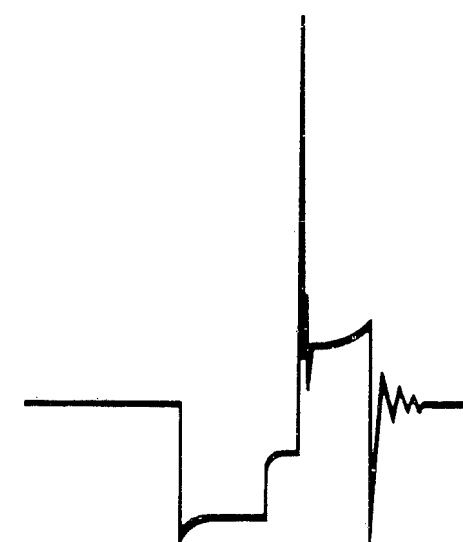
Engine-speed sensor signal

Reference-mark sensor signal



# RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER (Continued)

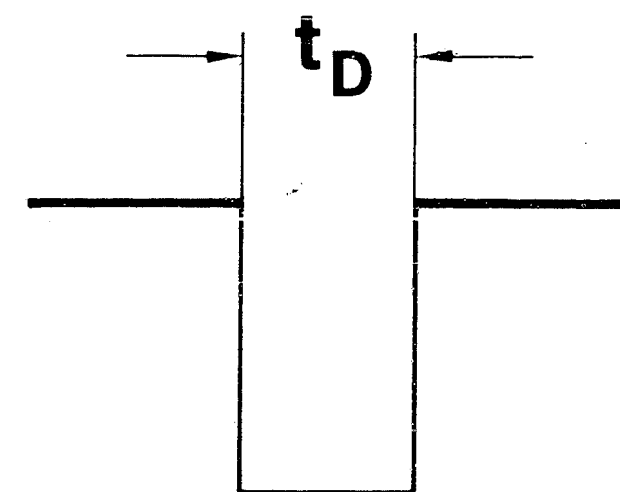
Test step	Switch position V	Ω	Measurement and remarks	Measurement at control-unit plug between terms.	Test specifications (reading)
18	3	15	Not applicable	10 and 5	—
19	4	15	Voltage of air-conditioning system (if present). Switch on air conditioner.	29 and 5	greater than 8 V
20	6	15	Voltage of main relay. Ignition on.	35 and 5	10...15 V
21	7	15	Voltage of main relay. Ignition on.	18 and 5	10...15 V
22	5	15	Ignition signal from ignition coil using oscilloscope. Ignition off. Connect control unit. Disengage gear and start.	1 and 5	Signal present (see upper illustration)
23	8	15	Supply voltage for air-flow sensor. Ignition on.	9 and 5	greater than 4,5 V
24	9	15	Wiper voltage of potentiometer in air-flow sensor. Ignition on.	7 and 5	Sensor flap at rest: 200...300 mV Sensor flap fully opened: greater than 4,2 V
25			Not applicable		
26	11	15	Not applicable		
27	12	15	Starting signal from term. 50. Disengage gear and start.	4 and 5	8...15 V
28	13	15	Dwell-period signal, using oscilloscope. Disengage gear and start.	21 and 5	See lower illustration.



261 / 0442

Ignition signal

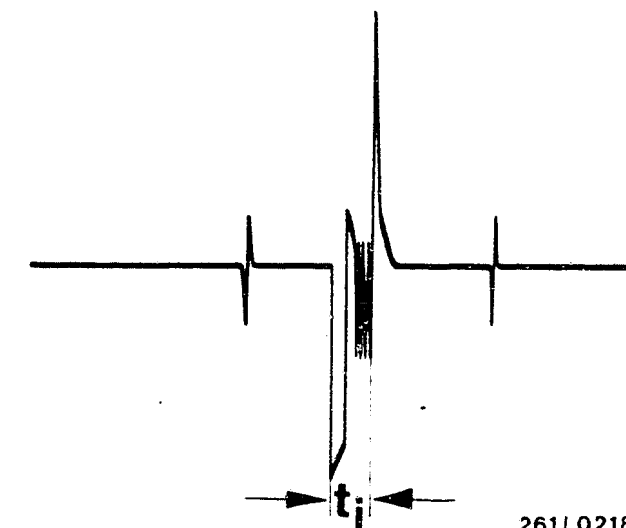
$t_D$  = Dwell period



261 / 331

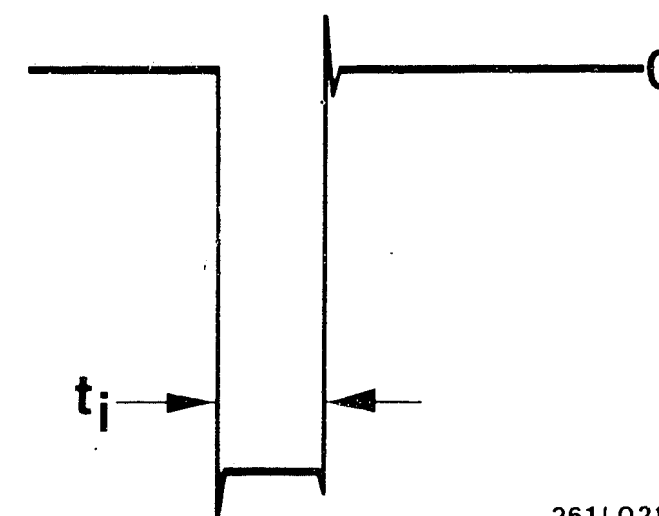
# RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER (continued)

Test step	Switch setting		Button	Measurement and remarks	Measurement at control-unit plug between term.	Test specifications (indication)
	V	$\Omega$				
29	14	15	—	Injection signal of control unit with oscilloscope. Gear in neutral and start.	14 and 5	See top picture
30	14	15	T1	As 29, however injection time is somewhat longer after pressing button (engine temperature sensor, cold). Press button for only approx. 2 seconds.	14 and 5	See top picture; $t_i$ becomes somewhat wider
31	15	15	—	As test step 29, however 2nd output for injection valves	15 and 5	See top picture
32	16	15	—	Injection signal of control unit with oscilloscope. Gear in neutral and start.	11 and 5	See bottom picture
33	17	15	—	Voltage at pump relay. Attach pump fuse. Ignition on.	20 and 5	10...15 V
34	17	15	—	Voltage at pump relay. Pump control in control unit is tested. Gear in neutral and start..	20 and 5	max. 4 V
35	17	15	T3	Fuel pressure test: Ignition off. Connect pressure gauge to test connection. Ignition on. Press button T3.	20 to ground	2,3...2,7bar 944 as of 9.88 3,6...4,0bar



261/ 0218

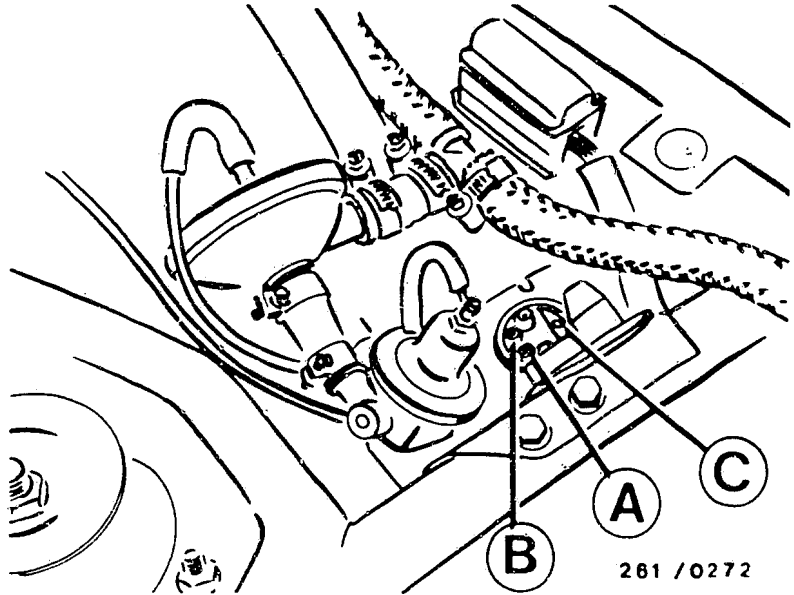
$t_i$  = Duration of injection



261/ 0214

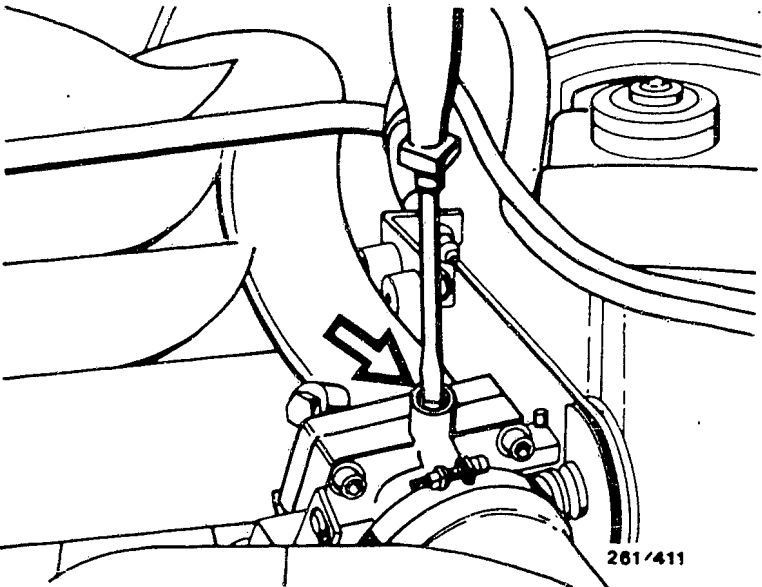
RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER (CONTINUED)

Test step	Switch position V	But ton	Measurement and remarks	Measurement at control-unit plug between terms	Test specifications (reading)
36	17	15	—	—	without lambda closed-loop control 0,5...1,5 vol. % CO with lambda closed-loop control 0,4...0,8 vol. % CO
			Test CO and idle speed: Connect motortester and diagnostic cable (1 684 463 095 or ..158).  On vehicles with lambda closed-loop control, connect CO tester to test connection before catalytic converter (in engine compartment on right).  When testing with adapter cable 1 684 463 124, separate lambda-sensor plug connection.  Carry out CO measurement first. Engine temperature approx. 90°C, intake-air temperature approx. 15...30°C, consuming devices switched off. Make adjustments quickly.		
			T5 and T6 For testing and adjusting idle speed, connect term. B and term. C at test socket with cable, or press buttons T5 and T6 simultaneously, and read off test value.  Remove cable at test base or release buttons, give a snap acceleration at the accelerator pedal, and check idle speed.		800...880 min <sup>-1</sup>



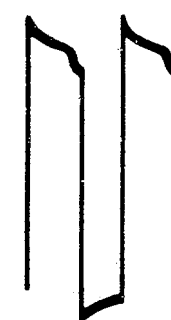
A, B, C = Terminals of test socket

Arrow = Adjusting screw for idle speed

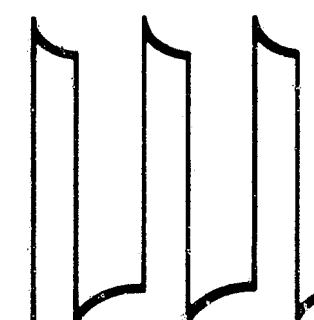


# RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER (CONTINUED)

Test step	Switch setting		Button	Measurement and remarks	Measurement at control-unit plug between term.	Test specifications (indication)
	V	$\Omega$				
37	17	15	—	Test ignition angle at idle speed: Run warm engine at idle speed ( $5^{\circ} \dots 15^{\circ} \text{ min}^{-1}$ ) Set engine speed precisely, otherwise incorrect ignition angle is indicated.	—	Vehicles with no cat. 800...880 Vehicles with cat.: $0^{\circ} \dots 10^{\circ}$
38	17	15	T5	Test overrun cutoff: Maintain constant engine speed $2000 \text{ min}^{-1}$ , Press button T5. No injection signals and engine speed fluctuates rhythmically.	2 to ground	Engine "hunts"
39	18	15	—	Signal at idle actuator. Run engine at idle speed.	33 and 5	See top picture
40	19	15	—	Signal at idle actuator. Run engine at idle speed.	34 and 5	See top picture



KI.33

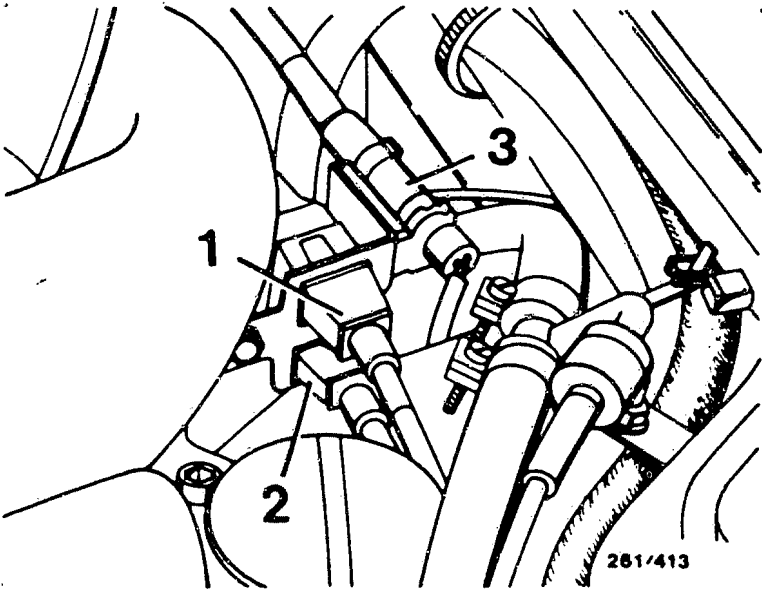


KI.34

261 / 412

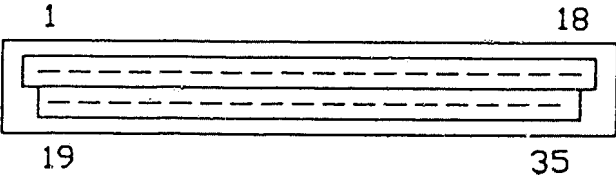
Signals at idle actuator

Test step			Termin-als	Testing of component/function Test instructions/conditions	Set values
Switch	V	Ω			
<p>Functional test on lambda closed-loop control only for vehicles with catalytic converter.</p> <p>Testing of lambda closed-loop control with adapter lead 1 684 463 128.</p> <p>If only the adapter lead 1 684 463 124 is available, the test steps can be performed as follows without adapter on a substitute basis:</p> <p>Detach lambda sensor plug and connect control-unit end of lead (term. 24) to ground (upper closed-loop control limit). To test lower closed-loop control limit, connect end of lead to positive terminal of 1.5 V single cell battery. Connect negative terminal of single cell battery to ground. Test closed-loop-control operation with sensor connected.</p> <p>Set values, see test steps 41, 42, 43.</p> <p>Connect CO tester ahead of catalytic converter. Run warm engine at idle speed.</p>					
41	20	22	24 to ground	Upper lambda closed-loop control limit. Test adapter connects term. 24 to ground. Note: Perform test briefly so as not to damage catalytic converter.	CO increases to above 1,5 vol.%
42	20	23	24 to +2V	Lower lambda closed-loop control limit: Test adapter connects term. 24 to +2V	CO drops below 0,4 vol. % Rough engine running
43	20	24	24 to lambda sensor	Lambda closed-loop-control operation. Test adapter connects term. 24 to lambda sensor.	0,4...0,8 vol. %
				As above, however detach air hose at pressure regulator and seal it. Observe CO value immediately.	CO value increases briefly and drops back to closed-loop control value above.



- 1 = Plug connection for speed sensor
- 2 = Plug connection for reference-mark sensor
- 3 = Plug connection for lambda sensor

Top view of 35-pin control-unit plug of Motronic wiring harness



## TEST SPECIFICATIONS

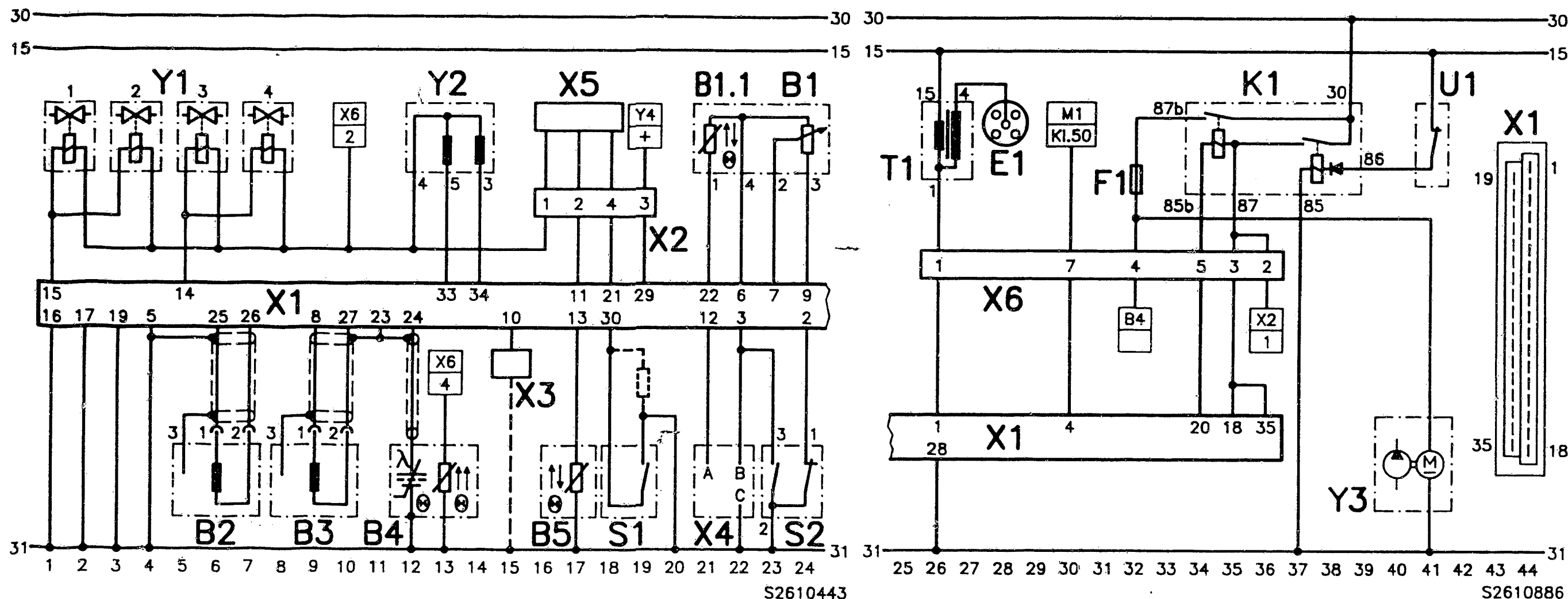
Pressure regulator		
Fuel pressure up to 8.88	2,3...2,7 bar	
Fuel pressure 944 as of 9.88	3,6...4,0 bar	
Electric fuel pump		
Delivery		
(measured in return line)	min. 900 cm <sup>3</sup> /30s	
Supply voltage		
(under load):	min. 12 V	
Temperature sensor (air)		
Internal resistance		
measured at air-flow sensor		
between term.22(1) and term.6(4)		
at ambient temperature		
(+15°C...+30°C):		
	1450...3300 k Ω	
Temperature sensor (engine)		
Plug colour blue.		
Internal resistance at		
ambient temperature		
(+ 15° C...+ 30° C):		
	1450...3300 k Ω	
Engine at operating temperature		
(approx. + 80° C):		
	280... 360 Ω	
Solenoid-operated injection valve		
Internal resistance		
at ambient temperature		
(+ 15° C...+ 30° C):		
	2...3 Ω	
944 as of 9.88:		
	5...6 Ω	
Air-flow sensor		
Internal resistance between:		
Term.7 (2) and term.6 (4):		
	8...1000 Ω (*)	
Term.9 (3) and term.6 (4):		
	500... 800 Ω	
(*) Deflect sensor flap as far as it will go.		

## TEST SPECIFICATIONS (CONTINUED)

Engine-speed sensor and reference-		
mark sensor, electrical internal		
resistance at ambient temperature		
(+15°C...+30°C):		
	600...1600 Ω	
Throttle-valve switch		
Resistance of idle-speed		
contact (term.1 and term.2):		
	approx. 0 Ω	
Resistance of full-load		
contact (term.3 and term.2)		
	approx. 0 Ω	
Altitude sensor		
above altitude of 1000 m,		
contact is closed:		
	approx. 0 Ω	
Below altitude of 1000 m,		
contact is open:		
	infinite Ω	
Idle actuator,		
electrical internal resistance		
at +15°...+30°C between		
term.4 and term.5:		
	17...19,5 Ω	
term.4 and term.3:		
	19...21,5 Ω	
Lambda sensor,		
resistance of heating winding		
	6...20 Ω	
Idle adjustment		
Engine at operating temperature,		
ambient temperature +15°...+30°C.		
Switch off consuming devices.		
Idle speed:		
(bridge at test socket terms.B		
and C )		
	800...880 min <sup>-1</sup>	
CO concentration: Without		
catalytic converter:		
	0,5...1,5 vol.% CO	
Vehicles with catalytic converter:		
(measure CO before catalytic		
converter, separate lambda-sensor		
plug)		
	0,4...0,8 vol.% CO	

For setting values for valve clearance and other technical engine data, see equipment and Autodata microcard.

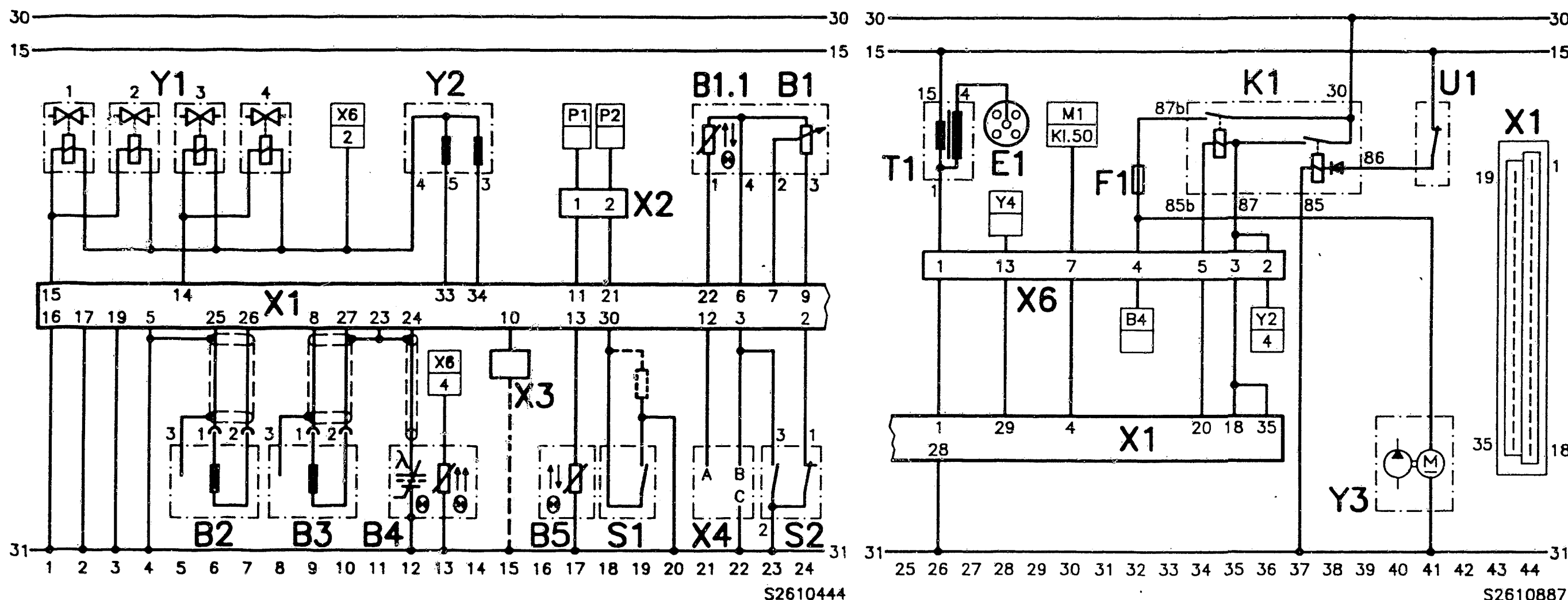




ELECTRICAL TERMINAL DIAGRAM FOR PORSCHE 924 S as of 9.87

B1 = Air-flow sensor  
 B1.1 = Temperature sensor (air)  
 B2 = Reference-mark sensor  
 B3 = Engine-speed sensor  
 B4 = Lambda sensor (heated) or dummy plug for vehicles prepared for catalytic converter  
 B5 = Temperature sensor (engine)  
 E1 = High-tension distributor  
 F1 = Fuse no. 2 in auxiliary fuse box  
 K1 = Pump and main relay (DME relay U at central-electrics console)  
 M1 = Starting motor  
 S1 = With catalytic converter:  
     Altitude sensor for USA (as illustrated)  
     or term. 30 open  
     With no catalytic converter:  
     Adapter plug connected with 1.8 k  $\Omega$

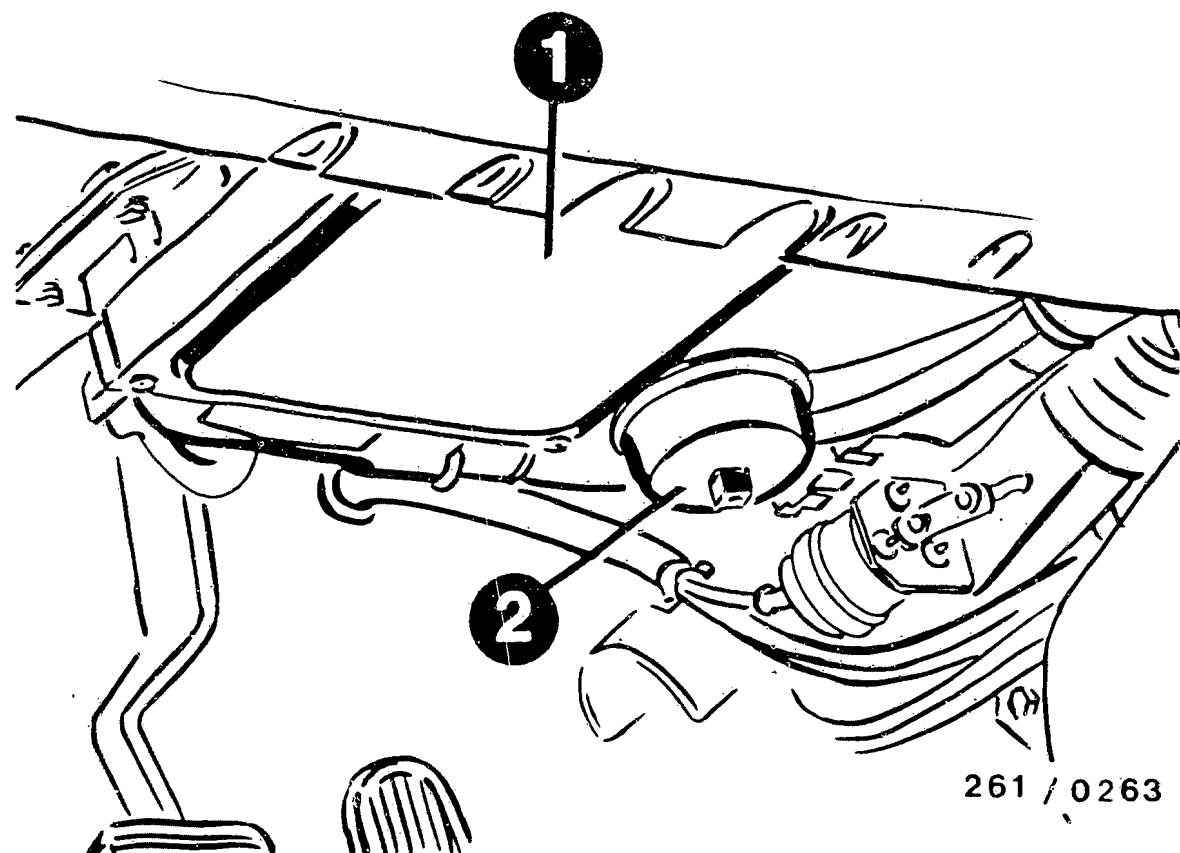
S2 = Throttle-valve switch  
 T1 = Ignition coil  
 U1 = Car alarm (if applicable)  
 X1 = Motronic control-unit plug  
 X2 = Plug connection in engine compartment  
 X3 = Map plug: Generally open; California and Japan connected  
 X4 = Test socket  
 X5 = Plug, instrument cluster (rev counter)  
 X6 = Plug connection in engine compartment  
 Y1 = Injection valves (cyl. 1,2,3,4)  
 Y2 = Idle actuator  
 Y3 = Fuel pump  
 Y4 = To refrigerator compressor



ELECTRICAL TERMINAL DIAGRAM FOR PORSCHE 944 as of 9.87

B1 = Air-flow sensor  
 B1.1 = Temperature sensor (air)  
 B2 = Reference-mark sensor  
 B3 = Engine-speed sensor  
 B4 = Lambda sensor (heated) or dummy plug for vehicles prepared for catalytic converter  
 B5 = Temperature sensor (engine)  
 E1 = High-tension distributor  
 F1 = Fuse no. 34 in central-electrics console  
 K1 = Pump and main relay (G5 in central electrics console)  
 M1 = Starting motor  
 P1 = Consumption indicator  
 P2 = Rev counter  
 S1 = With catalytic converter:  
       Altitude sensor for USA (as illustrated)  
       or term.30 open

With no catalytic converter: Adapter plug connected with 1.8 k  $\Omega$ .  
 S2 = Throttle-valve switch  
 T1 = Ignition coil  
 U1 = Car alarm  
 X1 = Motronic control-unit plug  
 X2 = Plug connection in engine compartment  
 X3 = Map plug: Generally open;  
       California and Japan connected  
 X4 = Test socket  
 X6 = Plug connection in engine compartment  
 Y1 = Injection valves (cyl. 1, 2, 3, 4)  
 Y2 = Idle actuator  
 Y3 = Fuel pump  
 Y4 = To refrigerator compressor



924 S: 1 = Control unit  
2 = Altitude sensor

## INSTALLATION POSITION OF COMPONENTS

The installation locations always refer to the direction of travel.

Control unit:

924 S: Beneath instrument-panel trim, in front of steering column

944 : On passenger side, behind footwell cover

Altitude sensor or adapter plug with 1.8 k  $\Omega$  for 924S and

944 : next to control unit

Motronic relay (main and pump relay):

924 S: at central-electrics console, DME relay (U) to left of steering column.

944 : in central-electrics console, DME relay (G5), on left in engine compartment.

## INSTALLATION POSITION OF COMPONENTS (CONTINUED)

Reference-mark and engine-speed sensor:

At crankcase flange beneath oil filler neck.

Temperature sensor (air):

In air-flow sensor.

Temperature sensor (engine):

On left-hand side of engine, between cyl. 1 and 2 (blue plug).

Ground terminals:

At clutch housing and at engine block, in vicinity of engine-speed and reference-mark sensor.

Idle actuator:

Beneath intake distributor

Lambda sensor:

In joint exhaust pipe ahead of catalytic converter.

Temperature switch + 58° C:

Beneath intake manifold at 4th cylinder.

Throttle-valve switch:

At throttle-valve assembly.

Trouble-shooting instructions : VAU-5000

BOSCH system : EI

Make of vehicle : VAUXHALL

Basic microcard : PKW-071

## TABLE OF CONTENTS

Section	Coordinate
Special features, usage, safety.....	02
Trouble-shooting chart.....	05
Rapid diagnosis chart.....	07
Test specifications.....	17
Electrical terminal diagram.....	21
Installation position of components Removal and installation instructions.....	23

## SPECIAL FEATURES

These brief instructions, valid at the time of publication, apply to the following Vauxhall model:

Astra GTE, Cavalier 1.8 l  
with 1.8 l/ 4-cyl. engine 18 SE 9.86 ->.

\* EI control unit 0 227 921 037

\* Ignition coil with trigger box 0 221 600 053  
(with current limitation)

\* Perform ignition-angle test with shorting  
device 1 684 487 003.

\* Perform trouble-shooting and fault rectifi-  
cation for test step "EI-CONTROL UNIT FUNCTION"  
as follows:

If set value is not attained, test lead from  
EI control unit plug term. 13 to trigger-box  
plug term. 4 for open-circuit and/or short-circuit  
to ground.  
Eliminate open-circuit, short-circuit to ground.

Detach trigger-box plug and connect  
240...270  $\Omega$  resistor to term. 4 and term. 2.  
Connect oscilloscope "special" with red terminal  
to trigger-box plug term. 4 (+)  
and black terminal to vehicle ground.  
Start engine.  
Oscilloscope must show a rectangular pulse of  
at least 2.5 V.

Renew trigger box if set value is attained.  
Renew EI-control unit if set value is not  
attained.

STRUCTURE AND USAGE

Tnese brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.  
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

CAUTION!  
High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

## TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Idle problems (engine speed, exhaust gas).
4. Poor throttle take-up, flat spot during acceleration.
5. Engine missing (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on.
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

Cause (component fault)										
*			*							High-tension side
*										Firing sequence
*			*							Ignition coil
*										Voltage, EI-control unit
*										Voltage, trigger box
*										Insulation, pulse generator
*										Internal resistance, pulse generator
*										Voltage, pulse generator
*										EI-control unit function
*										Primary signal
*										Contact resistances (primary side)
*										Engine-speed signal

## TROUBLE-SHOOTING CHART (CONTINUED)

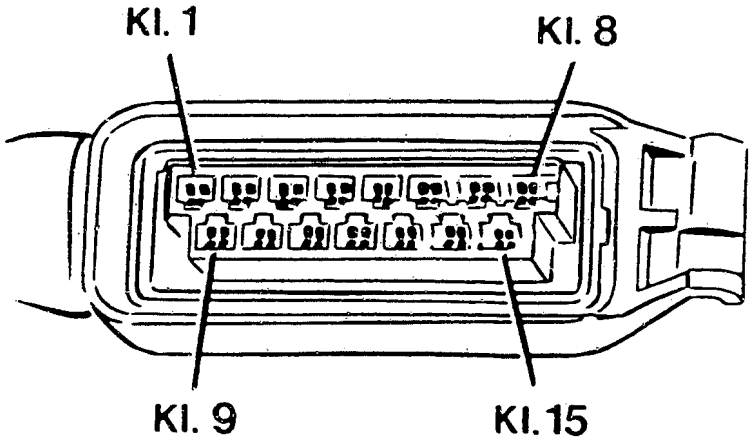
Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Idle problems (engine speed, exhaust gas).
4. Poor throttle take-up, flat spot during acceleration.
5. Engine missing (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

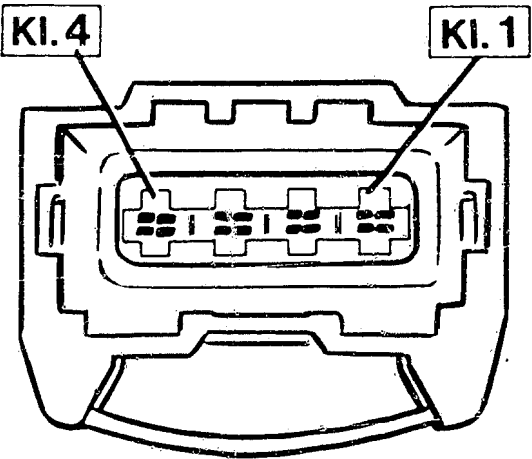
Cause (component fault)										
				*	*		*			Ignition angle
		*	*	*	*					Throttle-valve switch (idle)
	*	*		*						Throttle-valve switch (full load)
							*			Temperature sensor (engine)
		*		*			*			Load signal
			*							Voltage, ignition coil
				*	*		*			Octane number adjustment

RAPID DIAGNOSIS CHART

Test step	Testing of component/function Test instructions/conditions	Termi- nals	Set values
1	HIGH-VOLTAGE SIDE Check operation (e.g. open circuit, shunt) of, for example, spark plugs, ignition harness, distributor cap etc. Evaluation for example by ignition oscilloscope, resistance measurement, visual examination.	—	—
2	IGNITION COIL Visual examination: plug present, sealing compound escaped? Resistance, primary Resistance, secondary	—  1 15 1 4	—  0,6... 1,0 Ω 6,4...11,1 k Ω
3	VOLTAGE, EI CONTROL UNIT Detach EI control-unit plug. Ignition ON. Voltage, EI control-unit plug. See upper illustration.	3 1 (+) (-)	Battery voltage
4	VOLTAGE, TRIGGER BOX Detach trigger-box plug. Ignition ON. Voltage, trigger-box plug. See lower illustration.	3 2 (+) (-)	Battery voltage
5	INSULATION, PULSE GENERATOR EI control-unit plug is detached. Resistance, EI control-unit plug. See upper illustration.	1 12	infinity Ω



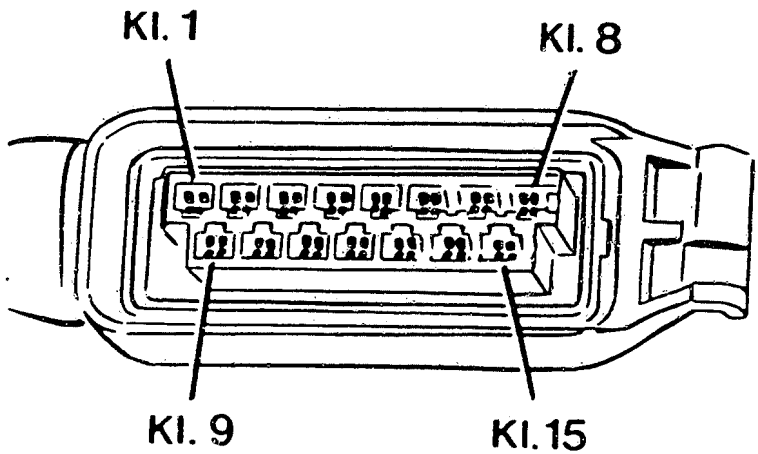
227 / 354



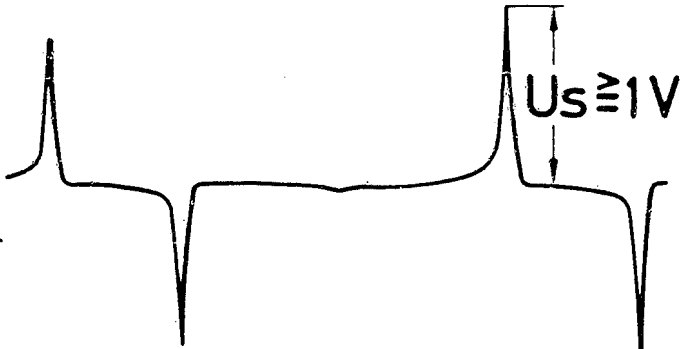
227 / 1082

RAPID DIAGNOSIS CHART (CONTINUED)

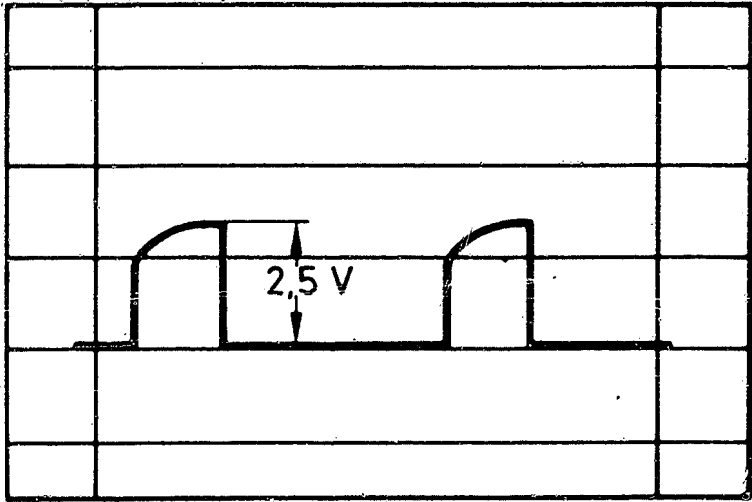
Test step	Testing of component/function Test instructions/conditions	Termin- als	Set values
6	INTERNAL RESISTANCE, PULSE GENERATOR EI-control unit plug detached. Resistance, EI-control unit plug. See top picture.	11 12	445...785 $\Omega$
7	VOLTAGE, PULSE GENERATOR EI-control unit plug detached. Connect oscilloscope "special" to EI-control unit plug. See top picture. Start engine.	12 11 (+) (-)	Equal to/greater than 1 V (center picture)
8	EI-CONTROL UNIT FUNCTION Attach EI-control unit plug. Attach trigger-box plug and push back rubber sleeve. Connect oscilloscope "special" to trigger-box plug. Start engine. * Note: The minimum voltage is important and not the profile (edges may be smooth).  Refer to SPECIAL FEATURES Section for trouble- shooting and fault rectification.	4 2 (+) (-)	* Rectangular pulse Equal to/greater than 2.5 V (bottom picture)
9	PRIMARY SIGNAL Trigger-box plug connected. Connect oscilloscope/engine-speed tester to ignition coil. Start engine.	15 1 (+) (-)	Primary voltage/ engine-speed display (magnitude irrelevant)



227 / 354



227/1083

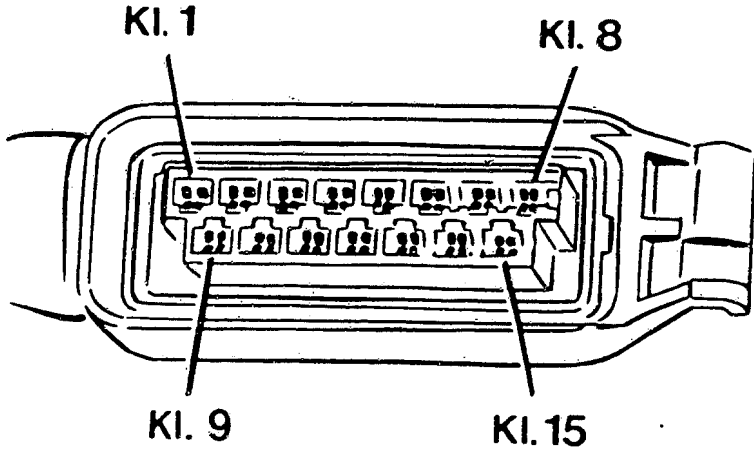


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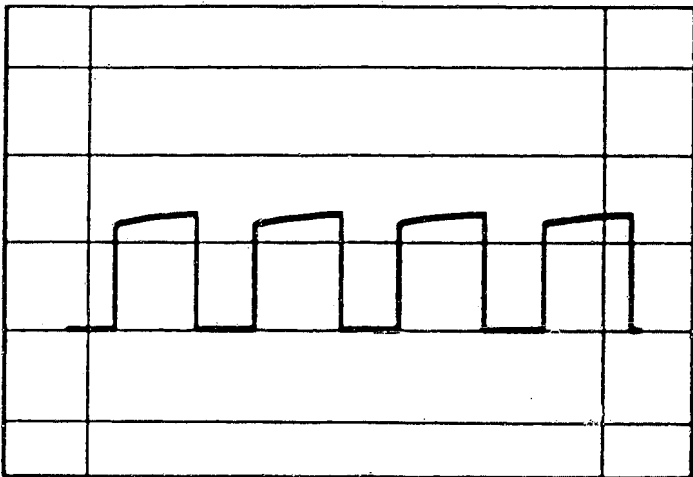


RAPID DIAGNOSIS CHART (CONTINUED)

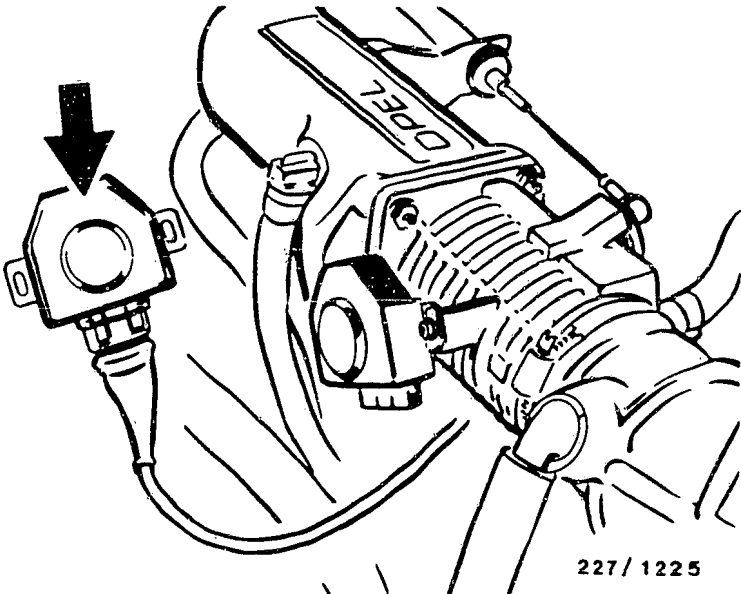
Test step	Testing of component/function Test instructions/conditions	Termin- als	Set values
10	CONTACT RESISTANCE (PRIMARY SIDE) Detach negative and positive lead from battery. Detach trigger-box plug. Ignition ON. Resistance between battery terminal and trigger-box plug.	B+ 3 B- 2	max. 0,5 Ω
11	ENGINE-SPEED SIGNAL Connect negative and positive lead of battery. EI-control unit plug connected. Detach LE-Jetronic control-unit plug. Connect oscilloscope "special" to LE-Jetronic control-unit plug. See top picture. Start engine.	1 B- (+) (-)	Rectangular pulse (center picture)
12	IGNITION ANGLE Attach trigger-box plug. Attach LE-Jetronic control-unit plug. Engine at operating temperature (oil temperature approx. +80°C). Connect Motortester with TDC sensor as per operating instructions. Connect shorting device 1 684 487 003 to detached throttle-valve-switch plug. See bottom picture. Run engine at 1800 min <sup>-1</sup> . Octane no. adjustment (encoding plug) = RON 98 Octane no. adjustment (encoding plug) = RON 95 Detach shorting device. Attach throttle-valve-switch plug.	— —	15...19° BTDC 10...14° BTDC



227 / 354



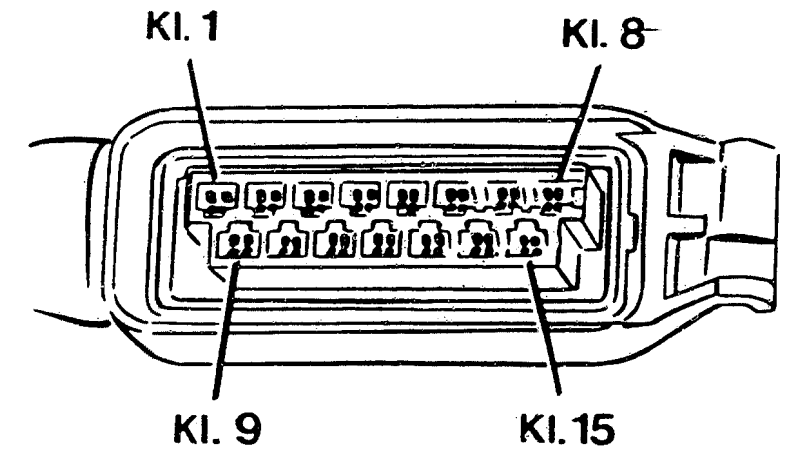
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227 / 1225

## RAPID DIAGNOSIS CHART (CONTINUED)

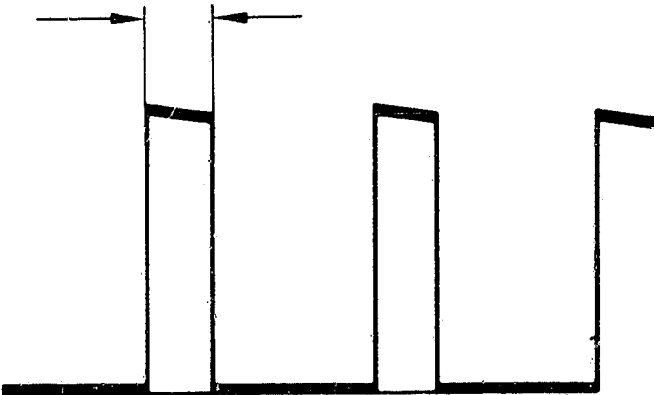
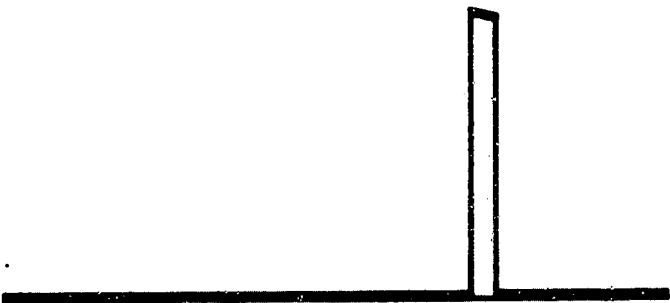
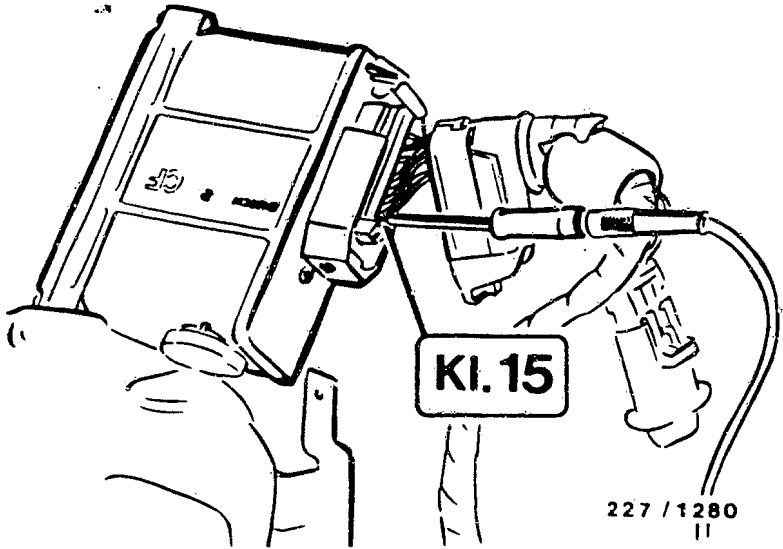
Test step	Testing of component/function Test instructions/conditions	Terminals	Set values
13	<p>THROTTLE-VALVE SWITCH (IDLE)</p> <p>Detach LE-Jetronic and EI-control unit plugs. See picture.</p> <p>Resistance, EI-control unit plug.</p> <p>Throttle valve in idle position.</p> <p>Open throttle valve 1...2° (part-load position).</p>	6 1	<p>approx. 0 Ω</p> <p>(continuity)</p> <p>Infinity Ω</p>
14	<p>THROTTLE-VALVE SWITCH (FULL LOAD)</p> <p>LE-Jetronic and EI-control unit plugs detached.</p> <p>Resistance, EI-control unit plug. See picture.</p> <p>Fully depress accelerator pedal.</p> <p>Release accelerator pedal (idle position).</p>	14 1	<p>approx. 0 Ω</p> <p>(continuity)</p> <p>Infinity Ω</p>
15	<p>TEMPERATURE SENSOR (ENGINE)</p> <p>EI-control unit plug detached.</p> <p>Resistance, EI-control unit plug (see picture) at temperature:</p> <p>+ 20° C =</p> <p>+ 30° C =</p> <p>+ 80° C =</p> <p>+ 90° C =</p> <p>+100° C =</p>	7 2	<p>2,1...2,9 k Ω</p> <p>1,4...2,0 k Ω</p> <p>280...370 Ω</p> <p>210...280 Ω</p> <p>160...210 Ω</p>



227 / 354

RAPID DIAGNOSIS CHART (CONTINUED)

Test step	Testing of component/function Test instructions/conditions	Termin- als	Set values
16	<p><b>LOAD SIGNAL</b> Attach LE-Jetronic control unit plug. Attach EI-control unit plug with handle cover detached. Connect oscilloscope "special" to EI-control unit plug and vehicle ground. See top picture. O R</p> <p>Connect dwell-angle tester to battery and EI-control unit plug.</p> <p>Allow engine to idle. Load signal must be present or read off and note down dwell angle.</p> <p>Briefly accelerate to full throttle (sudden acceleration) and observe load signal/dwell-angle display. There must be a noticeable change in the pulse duration of load signal/dwell angle.</p>	<p>15 B- (+) (-)</p> <p>B+ 15 (+) (-)</p> <p>—</p> <p>—</p>	<p>Load signal (center picture)</p> <p>Load signal (bottom picture, arrow)</p>
17	<p><b>VOLTAGE, IGNITION COIL</b> Voltage, ignition coil and battery. Engine idling.</p>	<p>15 B- (+) (-)</p>	<p>Equal to/greater than 10 V</p>
18	<p><b>OCTANE NUMBER ADJUSTMENT</b> Detach EI-control unit plug. Resistance EI-control unit plug.</p> <p>Encoding-plug: Brown (98 octane) color            Brown (95 octane)</p>	<p>8 10</p>	<p>470 <math>\Omega</math> 220 <math>\Omega</math></p>



# TEST SPECIFICATIONS

Ignition coil, primary	0,6... 1,0 $\Omega$
Ignition coil, secondary	6,4...11,1 k $\Omega$

Voltage, EI-control unit with ignition ON	Battery voltage
--	-----------------

Voltage, trigger box with ignition ON	Battery voltage
--	-----------------

Insulation, pulse generator	Infinity $\Omega$
-----------------------------	-------------------

Internal resistance, pulse generator	445...785 $\Omega$
---	--------------------

Voltage, pulse generator at cranking speed	Equal to/greater than 1 V
---	------------------------------

EI-control unit function at cranking speed	Equal to/greater than 2.5 V
---	--------------------------------

Primary signal at cranking speed	Primary voltage/ engine-speed display (magni- tude irrelevant)
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# TEST SPECIFICATIONS (CONTINUED)

Contact resistances Supply leads Trigger box	max. 0,5 $\Omega$
--	-------------------

Engine-speed signal at cranking speed	Rectangular pulse
--	-------------------

Ignition angle Engine at operating temperature (approx. + 80° C). Throttle-valve-switch plug jumpered with shorting device 1 684 487 003. Run engine at 1800 min <sup>-1</sup> Octane number adjustment	RON 98 15...19° BTDC RON 95 10...14° BTDC
--	--

Throttle-valve switch Idle Throttle valve, idle position Open throttle valve 1...2°	approx. 0 $\Omega$ Infinity $\Omega$
--	---

Throttle-valve switch Full load Fully depress accelerator pedal Accelerator pedal, idle position	approx. 0 $\Omega$ Infinity $\Omega$
---	---

TEST SPECIFICATIONS (CONTINUED)

Engine temperature sensor		
+ 20° C =	2,1...2,9	k Ω
+ 30° C =	1,4...2,0	k Ω
+ 80° C =	280...370	Ω
+ 90° C =	210...280	Ω
+100° C =	160...210	Ω

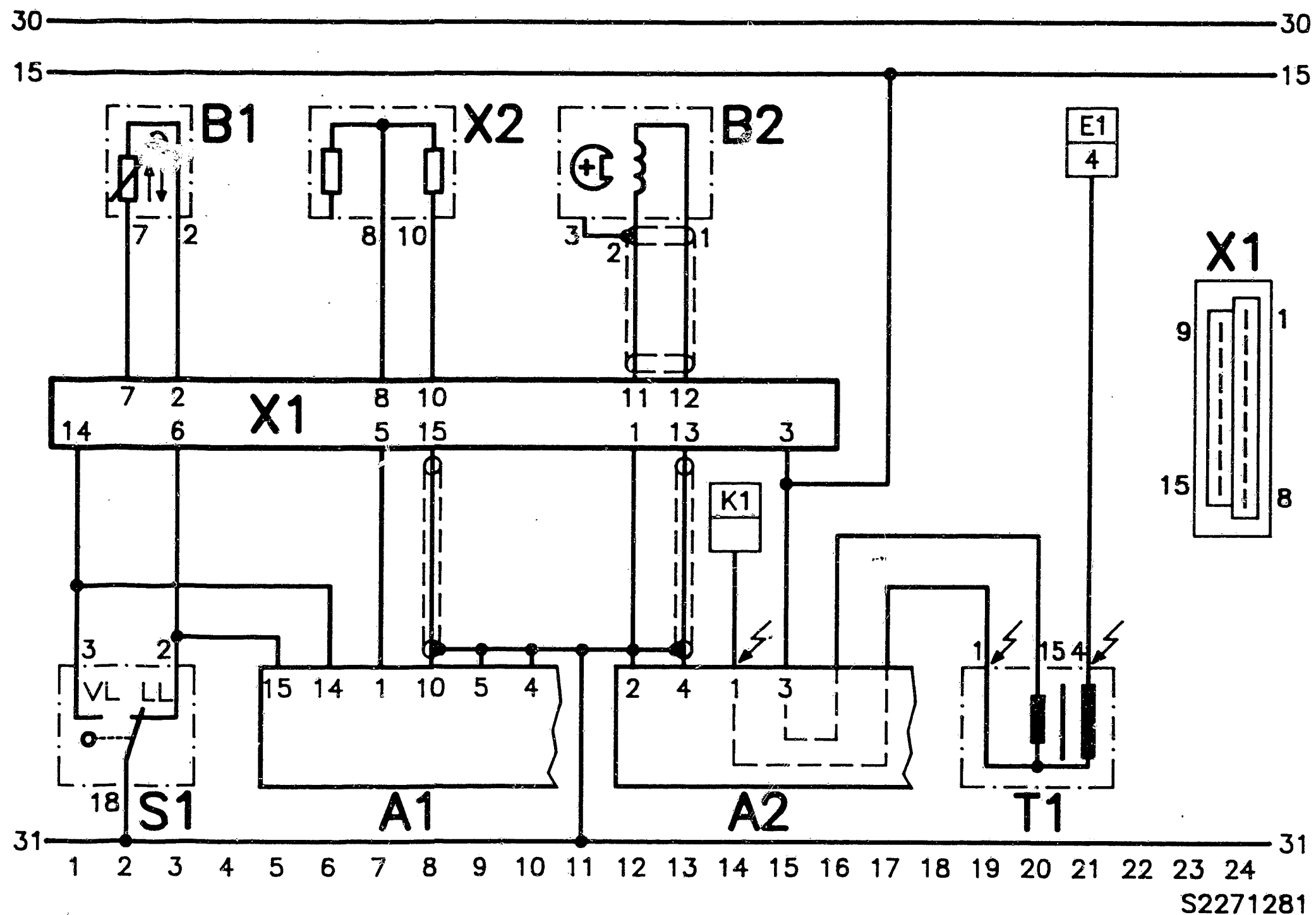
Load signal	
Briefly accelerate to full throttle	There must be a change in pulse duration

Voltage, ignition coil with engine idling	Equal to/greater than 10 V
---	----------------------------

Encoding plug brown	(98 octane)	470 Ω
brown	(95 octane)	220 Ω

Please refer to SIS Microcard "LE-Jetronic" or Autodata test specifications for settings as regards idle speed, exhaust gas etc.

For production reasons:  
continued on the following  
coordinate.

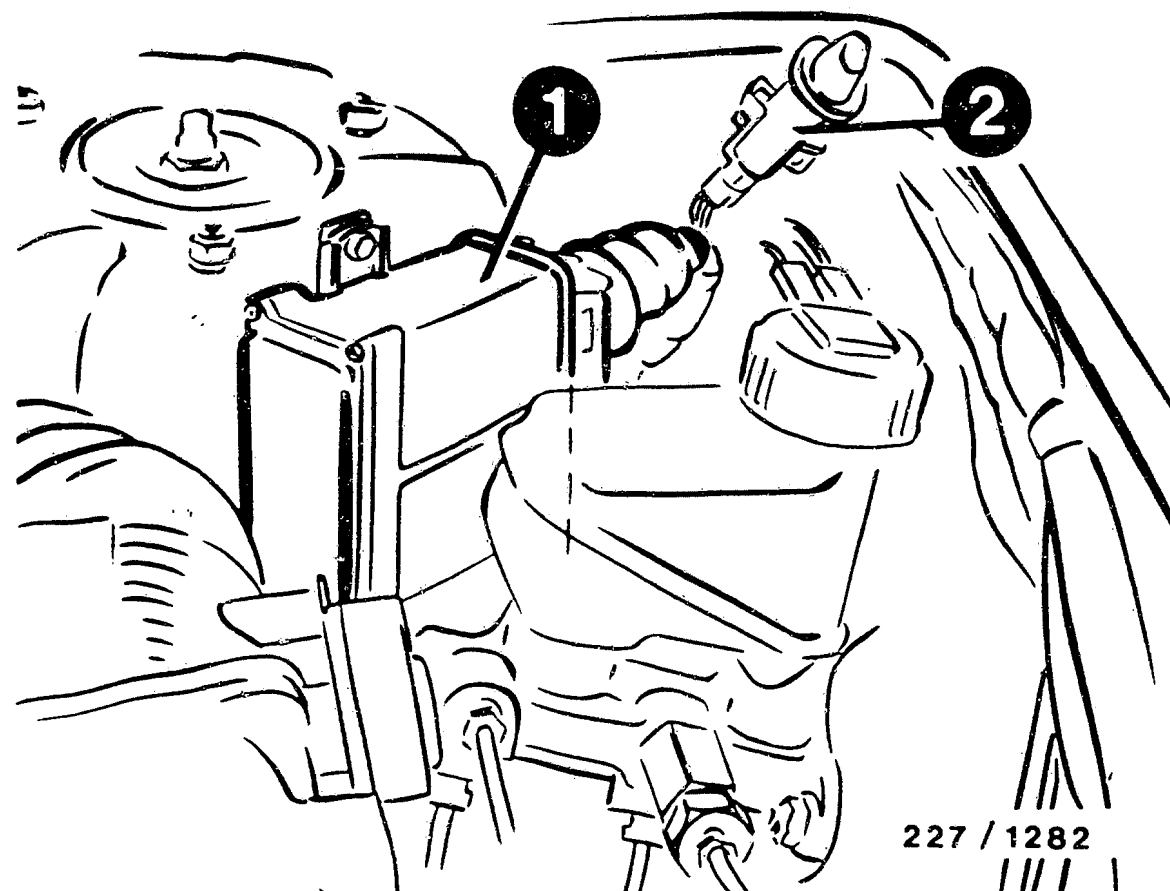


# ELECTRICAL TERMINAL DIAGRAM

High-tension arrows: Caution 400 V...25 kV

A1 = LE-Jetronic control unit  
A2 = Trigger box  
B1 = Temperature sensor (engine)  
B2 = Pulse generator  
E1 = to high-tension distributor

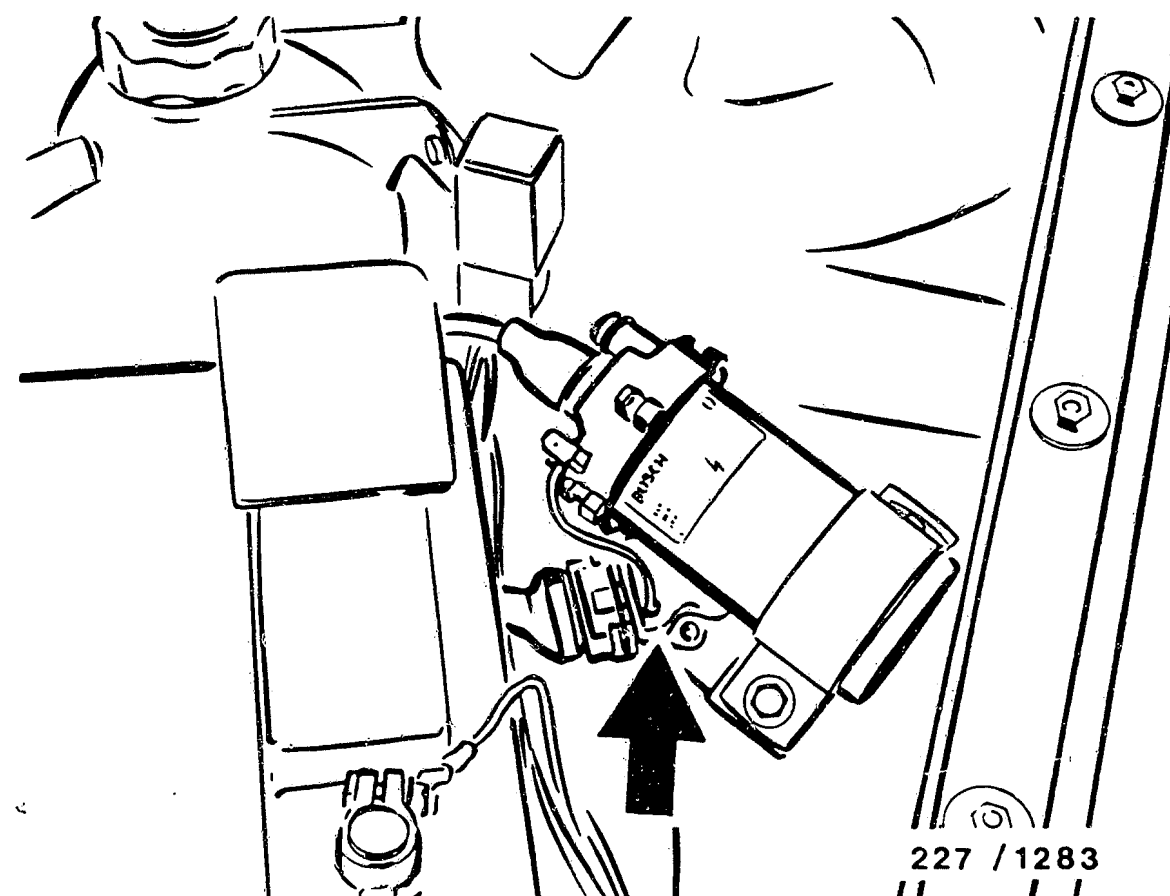
K1 = to rev counter  
S1 = Throttle-valve switch  
T1 = Ignition coil  
X1 = EI-control unit plug  
X2 = Encoding plug (octane number adjustment)



- 1 = EI-control unit (e.g. for Cavalier model)  
2 = Encoding plug (e.g. for Cavalier model)

#### INSTALLATION POSITION OF COMPONENTS

EI-control unit (picture, item 1) and encoding plug (picture, item 2) are located in rear right of engine compartment (direction of travel).



Arrow = Trigger box with ignition coil  
(e.g. Cavalier model).

#### INSTALLATION POSITION OF COMPONENTS (CONTINUED)

Trigger box and ignition coil are located beneath battery.

## INSTALLATION POSITION OF COMPONENTS (CONTINUED)

- \* The temperature sensor (engine) is located in the vicinity of the oil filter.
- \* The pulse generator is located in the vicinity of the dipstick.
- \* The throttle-valve switch is located at the throttle-valve assembly.
- \* The high-tension distributor is located at the cylinder head, rear.
- \* The LE-Jetronic control unit is located at the air-flow sensor.

For production reasons:  
continued on the following  
coordinate.